Volume VIII No. 2 SUMMER 2000

QRPp

Summer 2000

Journal of the Northern California QRP Club

Table of Contents

From The Editor

by Doug Hendricks, KI6DS

There is a lot going on in QRP these days, and one of the first things that you probably want to know about is what is going on with QRPp? As you know, I had triple bypass surgery last year, and we got way behind with QRPp. The winter issue did not come out until May, and the spring issue is still not out. The copy was sent to the printer in early May, but he has had several things get in the way of his being able to complete the issue. It will be mailed.

I was gone on an extended vacation with my wife as I visited the east coast again this year, and did not have my finger on top of things. When I returned in August, I fully expected QRPp to have been sent, and it wasn't. I started on the summer issue and have had it finished for several weeks, but have been waiting for the spring issue to be mailed.

I did not want to mail the summer issue until the spring one came out, as it does not give guys time to renew. The decision has been made to go ahead and mail the summer issue, and to give anyone who had their subscription expire the summer issue, hoping that they will go ahead and subscribe.

We have been in this situation before, and it is obvious to me now that we must print QRPp locally, so that I can keep tabs on things. It is not fair to the subscribers to have this happen. The plan is to mail this issue as soon as it gets back from the local printer, and to do the fall issue

immediately, with it shipping by Pacificon if at all possible. I thank each one of you for your patience. I will take full responsibility for the lateness of QRPp and will see that it gets out on time in the future.

We have a new membership manager. Paul Maciel, AK1P, has been doing the data base management for us for some time, and is doing a fabulous job. All questions about your subscription should be addressed to Paul. Here is his contact information:

Snail Mail:
Paul Maciel
1749 Hudson Dr.
San Jose, CA 95124

Email:
pmaciel@inow.com

Many of you are also anxious to hear about the progress of the full featured 10 meter surface mount kit. Mike Gipe, K1MG, is the designer, and he has been buried at work. When I returned from vacation, Mike contacted me and told me that he would not be able to even think about working on the project until late fall. The project is still in the works, but it has been delayed.

Sometimes you get lucky. Dan Tayloe, N7VE, has designed a wonderful new transceiver that uses the patented Tayloe mixer, and will be on 40 meters. It does not use ANY 602's at all!!! This is exciting news, as they are very hard to come by at this time. Dan's rig is going to be a portable operators delight. It will be a hybrid kit, using both surface mount and through hole components.

The rig is called the Mini-Stinger. We will package it as a complete kit, with a case, all controls, and even a built in Antenna Tuner!! The rig will have RIT, Keyer, built in Antenna Tuner, SWR indicator, Audio Frequency Annunciator, self contained battery holders for 6 double A batteries, and will run from 5 to 18 Volts!! The best thing about this rig is the current drain. Dan's prototype draws about 7 mils of current. This could be the all time low current champion. The transmitter will put out about 3 watts and be continuously variable from 0 to 3 W. We plan on doing a painted, silkscreened case, so all you will have to do when you finish building the kit is to grab your paddles, a piece of wire for an antenna, and get on the air!!

The goal is to sell this kit for less than $100 complete, and it doesn't look like there will be a problem. Dan will be one of the featured speakers at Pacificon, and I hope to see you there as he introduces the next NorCal kit.

Speaking of Pacificon, check out the exciting events that we have planned for you on pages 60 and 61 of this issue.

Thanks again for being patient with us. We are going to do a better job of getting QRPp out to you in a timely fashion. 72, Doug, KI6DS

The "L" Network, Revisiting an Old Favorite Tuner

by John Kirby, N3AAZ
204 Holly St.
Centreville, MD 21617

What do these terms have in common? QRP, backpacking, efficiency, zero-weight feedline, low pass filter, stealth, home brew, omni-directional, all band, an outstanding tuner?

Answer . . . One inductor and one capacitor, the "L" Network

Figure 1 shows a no feedline, portable, long wire antenna system I used a few years ago in a pop-up camper. This setup will match most 100 foot long wire antenna configurations form 80 through 10 meters. The coil is 21 turns of solid 18 AWG wound on a "stack" of three, Micrometals, RED (MIX 2), T94-2, powdered iron cores, with a "tap" placed every three turns (Figure 3). The capacitor is a 200 pico Farad variable. The antenna wire is a small roll of inexpensive, insulated, stranded, zip cord. You will need "alligator" clips and a tuning indicator. The earth ground "system" is just a common screwdriver and "vice-grip" (wire clamp).

Coax feedline was not required (in Figure 1) because the "L" network is connected direct between transceiver and base (or feed point) of the antenna. The feedpoint of the long wire antenna is located inside the shack (camper, tent or sleeping bag).

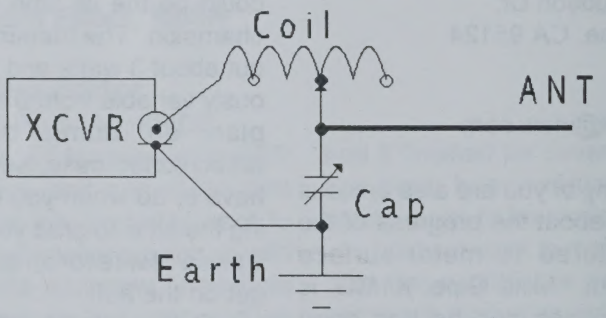
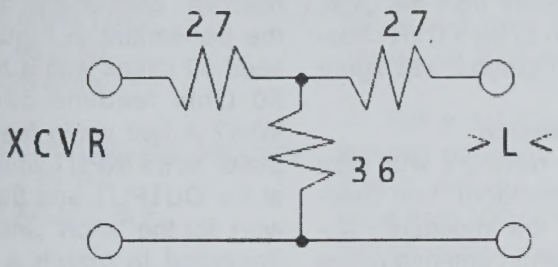


Fig. 1 "Long" ANT-No Feedline

Since the tuning indicator can take many forms it is noteworthy to say, that if it takes too long to adjust ANY antenna tuner, the "fi-

21 Total Turns, Tap Every Third Turn

Fig. 3 Coil Detail



Use high Watt carbon resistors

Fig. 4 50 Ohm, 10dB Attenuator

nal RF amplifier" in your transmitter may be at risk to over heating. I suggest, install a 10 dB attenuator (figure 4) between the transmitter and tuner to help protect the PA transistor during the *initial* adjustment. The "attenuator" technique is NOT a guarantee. The safest method is reduced transmitter power and short (intermittent) "key down" adjustments. The attenuator is removed for *final* adjustment and QSOs.

The "L" Network

For the purpose of this discussion the term long wire antenna refers to a non resonant wire element that is either, straight line, zigzag, horizontal, vertical, or combination, but always longer than a half wave at the operating frequency, a counterpoise is not required but a good earth ground helps.

The approximate half wave length in feet can be determined by dividing 468 by the operating frequency in MHz. Example, Length(ft) = 468 /F(MHz), a half wave at 7.04 MHz is approximately 66.5 feet.

How does the "L" network match a low impedance transmitter to high impedance long wire? Connect the coil in series between the XCVR / ANT junction and con-

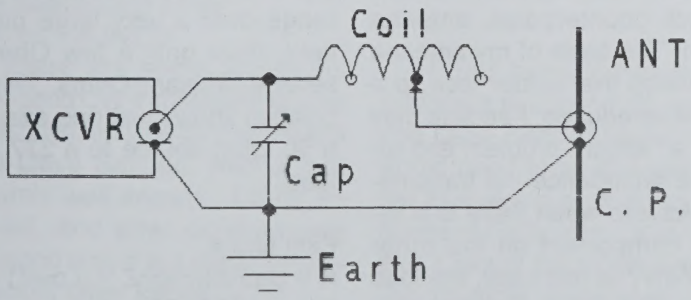


Fig. 2 "Short" ANT

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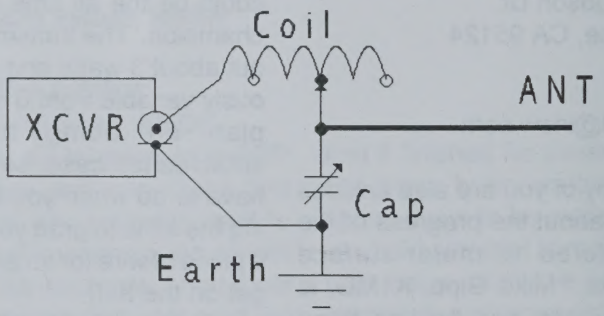

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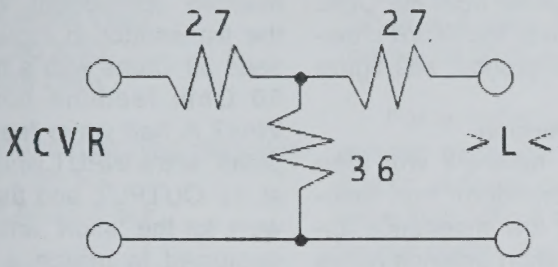

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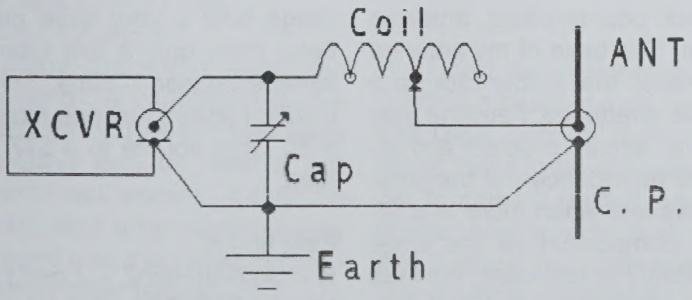


Fig. 2 "Short" ANT

nect the capacitor from the COIL / ANT junction to the XCVR chassis and earth ground, see figure 1.

The Short Version

The "L" network will also match most random, non resonant, "short", low impedance antennas. The short antenna refers to a wire or rod (whip), straight line, zigzag, vertical, horizontal or combination but always less than a quarter wave at the operating frequency. Any short antenna may be a compromise, and efficiency can be poor. Always use a counterpoise for best results. When matching a highZ (50 Ohm, transmitter) to lowZ (15 Ohm, short vertical) the inductor is connected in series between source and load. The capacitor is "shunt" or parallel to the source, see Figure 2. Note, this configuration is unlike (different) the "long" example above.

Today our camper is a fifth-wheel with an eight-foot aluminum ladder rack. I just add a Radio Shack # 21-937B Rack Mount Bracket and 108 inch whip to create a very nice support AND ladder rack counterpoise, antenna system. The base of my antenna is now atop that ladder rack so a feedline is required. Feedline may assert a "length" problem and affect the impedance the transmitter looks into when there is a reactive component on the other end. Why? In this case, the load (on the end of the feedline) is a non-resonant length of wire, i.e. reactive component. Therefore, the transmitter in Figure 2 only sees 50 Ohms with a half wave, 50 Ohm feedline connected. Why? A half wave feedline "repeats" at it's INPUT what it "sees" at it's OUTPUT and the "L" network for the "short" antenna was designed to match a 50 Ohm source to a short 15 Ohm (approximate) short vertical antenna with an undefined counterpoise. Solution, adjust (re-tune) the "L" Network for each band and / or change the length of the feedline a foot or two.

Conclusions

Exclude the feedline and it is noteworthy to say, the networks shown in Figures 1 and 2 match the Smith Chart yin / yang curves, i.e., there is most likely no point on the chart one or the other network will not match to 50 Ohm. Include a feedline of random length and the "L" network may not tune all the bands, however, the operative word is "random" length feed line.

Some Theory and a Little Math

The impedance presented by the end of a random wire can range over a very large playing field, from only a few Ohms to several thousand Ohms. This calculation shows just one example, a 50 Ohm source to a 377 Ohm load.

First find K

K = Sq.Rt.((HighZ / LowZ) - 1)

K = ((377 / 50) -1) ^ 0.5

K = 2.56

Next find X(L), reactance of the matching coil.
X(L) = K times LowZ
X(L) = 2.56 X 50
X(L) = 128 Ohm

Next find the matching coil value
If X(L) = 2 Pi F L
then L = X(L) / 2 Pi F

L = 128 / (6.28 X 7.04E6) >>7.040 MHz<<
L = 2.89E-6 or (2.89 uH)
The series inductor should be approximately 3 micro Henry

Next find X(C), reactance of the matching capacitor.
X(C) = HighZ / K
X(C) = 377 / 50
X(C) = 7.5 Ohm

Next find the matching capacitor value,
if X(C) = 1 / (2 Pi F C)
then C = 1 / (2 Pi F X(C))
C = 1 / (6.28 X 7.04E6 X 7.54)
C = 3E-9
(3E-9) is 3 nano Farad or 0.003 micro F or 3000 pico F

For a 1:1 SWR, make C a variable capacitor. For example, if your variable capacitor has a value from 100 pF to 1000 pF with 500 pF center, then calculate from the example above:

(3000) - (500) = 2500 pF

and then parallel fixed capacitors that total approximately 2500 pF with the 1000 pF variable.

To Bill, KD7S and L.B., W4RNL for their guidance and knowledgeable assistance, my pleasure, THANK YOU.
NOTE: I choose that all the above remain in public domain for Amateur Radio use. 72, John Kirby, N3AAZ
Comments and suggestions are welcome
n3aaz-qrp@juno.com

"Two for the Road"
A Two Band Transceiver for 40 and 20 Meters

By Wayne McFee NB6M
2379 Saint George Drive
Concord, CA 94520

There are some wonderful monoband CW transceiver kits out these days, and the SW series kits from Dave Benson, NN1G, are certainly well known. I built an SW-40, and after experiencing how good a rig it is, I started thinking about other bands.

I had been thinking about building a multiband rig, and queried Dave Benson about what all would need to be changed in order to make a multi-band rig out of one of his boards. It turned out that it would be much simpler to use multiple transceiver boards

than it would be to build the circuits and switching necessary to make a multi-band rig out of one board. So, I decided to build a two-band rig using one more of NN1G's SW series boards to go along with the SW-40 I already had.

After thinking for a while about what sort of features I wanted to incorporate, and having read the extensive treatment on tweaking the 40 Meter version of the board that was featured in the ARRL's book AQRP Power, I decided that I wanted dual VFOs, a fine tune control, a built-in Tick Keyer, a built-in Audio Frequency Annunciator, and a Keyer paddle built right into the front panel of the rig. With Dual VFOs, Split operation could be accomplished by manually switching from one VFO tune control to the other, when needed.

As I already had a board for one of the most popular HF ham bands, it seemed only natural that the second board would be for the other most popular HF band, 20 Meters. So, I ordered an SW-20+ and a Freq-Mite frequency counter/audio annunciator from Small Wonder Labs, and a Tick Keyer Chip from Embedded Research.

Next, the switching circuitry was tackled. I wanted all controls and connectors to be switched between the two boards, so that no extra controls or connectors were needed and I didn't have to unplug and re-connect any of the electrical connections to the rig. I wanted the Tick Keyer and the Frequency Annunciator to work automatically with whichever board was powered up.

Although electronic switching of some of the elements was considered, it was unnecessary. Two Triple Pole, Double Throw toggle switches connect the antenna, audio output, Gain control and the dual VFO pots to the selected board. A Double Pole Double Throw toggle switch selects the desired VFO tuning control. The fine-tuning control is a 5K pot wired in series between Vr and the appropriate center pole of the Dual VFO selector switch. DC Power is supplied to the selected board by a center off position toggle switch on the front panel.

The Tick Keyer is electronically connected to the key lines of both boards by adding a 1N914 diode in series between each key line and the Key Jack, and connecting the keying transistor powered by the Tick Chip right across the Key Jack, with the keying line from the Tick Chip run to the base of that transistor. So that the Freq Mite receives supply voltage no matter which board was powered up, the anodes of two 1N914 diodes were attached to the two on terminals of the center-off power switch, their cathodes were connected together, and the supply voltage for the Freq Mite was taken from that point.

The 5 Volts regulated for powering the Tick Keyer is taken from the regulator circuit in the Freq-

Mite, so it has power no matter which board is activated. The Freq-Mite samples the transmitted frequency of whichever board is powered up at point B in the circuit, the wiper of the RF Gain pot. Because of the Diode T/R switching scheme, there is more than sufficient RF there on transmit for the Freq-Mite to sample.

The Freq-Mite can be set up to announce just the last three digits of the sampled frequency, in the case of sampling a heterodyne VFO. The transmitted frequency is being sampled here, and, by appropriate positioning of small jumpers on the Freq-Mite printed Circuit board, the Freq-Mite is set up to announce all the digits of the sampled RF. In practice, one needs only to key the rig momentarily, activate the Freq-Mite by pressing a push button on the front panel, and unkey the rig. The Freq-Mite then announces in CW the sampled frequency, at a user selected CW speed. Generally I check the frequency in this manner after the end of a QSO so I can put the info in my log.

There is enough audio available from both the Freq-Mite (CW frequency announcement) and Tick Keyer (side tone and mode selection) so that the audio outputs from both those circuits are run through selected values of resistance directly to the earphone jack. A 330 Ohm resistor was placed in series with the audio output from the Freq Mite, and .1 uf Capacitor and a 1 KOhm resistor were placed in Series with the audio from Pin 3 of the Tick Keyer Chip. Your mileage may vary.

With the switching arrangement taken care of, the enclosure could be designed. At first, some thought was given to including a battery pack and a tuner in the rig. However, it was decided that having the battery pack outside the main enclosure would provide a very positive way of ensuring that the rig was off and preclude any chance for leakage or other corrosive problems from the battery pack. Since resonant antennas such as dipoles would be used in portable situations as often as non-resonant types, the tuner would be a separate item as well.

With those decisions made, work began on positioning the four circuit boards, all controls and connectors, and the built in Keyer paddle so as to end up with a small, QRP size enclosure. The material used for all the panels of the enclosure except the front panel is single sided PC board. It is very easy to cut, drill and shape, provides a built-in ground plane, and ends up being a good looking enclosure as well. Double sided PC Board was used for the front panel, as various items would be soldered directly to both sides of that panel.

Although there were some misgivings about what sort of interference and interaction problems might be created, the two main transceiver boards were placed back to back, spaced less

than one quarter of an inch apart. They are mounted on three tabs made from double sided PC Board, which are soldered to the left wall and rear panel of the PC Board enclosure. Operational tests performed upon completion of the rig proved that those misgivings were unfounded. No problems of any kind have been detected. Each board seems to act just like it would in a box all by itself.

The Keyer Paddle, Tick Keyer, Freq-Mite, Main Power switch and the two Band Switches are positioned to the right of the two main boards, with the power switch on the front panel, the paddle sticking out through the front panel, the two Band Switches on the rear panel, and the Tick Keyer and Freq-Mite boards attached to the right side panel of the enclosure.

The finished package, made from single sided PC Board material except for the front panel, looks quite nice and has no sharp edges or protruding screws. The front panel is made from double sided PC board because of the fact that various items are soldered directly to it, both front and rear. Both the front and rear panels are recessed 1/4" back from the front and rear edges of the top, bottom, and sides of the enclosure, which gives a pleasing look and also helps protect protruding switches, knobs and connectors. Although the paddle protrudes out about 3/4 of an inch from the front of the rig, about 1/4" further than the two largest knobs, I have had no problems with damage from carrying the rig in my backpack or in my suitcase.

With the front and rear panels recessed 1/4", I simply tack soldered the top and bottom panels on in two spots to the front panel and two spots to the side panels for each piece. Simple enough to get off when I really need to, and no screws needed.

Here are the specifications:

Enclosure size:
5 1/8" Wide, 4 1/2" Deep, and 2 1/8" High

Inside dimensions (front and rear panels inset 1/4"): 5" W, 4" D, 2" H

Front Panel Controls:
VFO 1 and VFO 2 Tuning
Fine Tuning
VFO Switch
Receiver RF Gain
Power On (20 Meters), Off, On (40 Meters)
Freq-Mite Activator Button
Tick Mode Control Button
Keyer Paddle (single or dual)

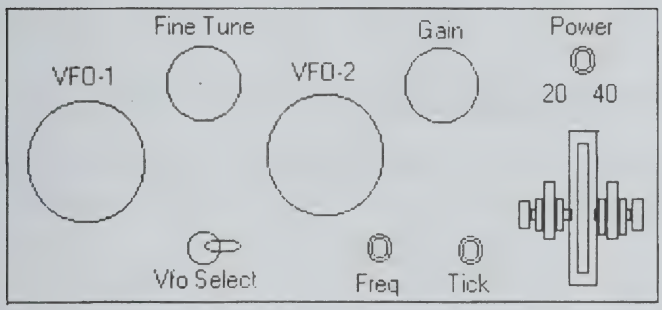
Rear Panel Controls:
Band Switches (two)(select either 20 Meters or 40 Meters)

Rear Panel Connections:
Antenna
DC Power
External Key (or External Keyer if desired)
Earphone (Low Impedance)

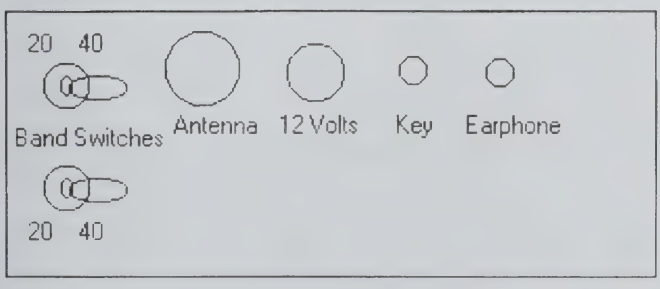
Transmitter Power Out, both bands 2.0 Watts with 13.8 Volt Supply (approximate)
1.5 Watts with 12.0 Volt Supply (approximate)

Here are the parts needed for the enclosure:

Front and Rear Panel Layout



NB6M SW-20/40 Front Panel Layout



NB6M SW-20/40 Rear Panel Layout

Power Switch, Center Off
SW-40
12 Volts
12 Volts
Freq Mite 12 Volts
SW-20
12 Volts
S-4
Two Triple Pole, Double Throw
Switches (Radio Shack, etc)
VFO 1
VFO 2
S-3
VFO 1 / VFO 2
Selector Switch
DPDT Switch
S-3A
S-3B
Antenna
Fine Tune
S-1
S-1A
S-1B
S-1C
SW-40 Antenna
SW-20 Antenna
SW-40 VR
SW-20 VR
SW-40 Tune Input
SW-20 Tune Input
SW-20/40 BAND SWITCHES
S-2
Receiver
RF Gain
S-2A
S-2B
S-2C
SW-40 RF In
SW-20 RF In
SW-40 RF Gain
SW-20 RF Gain
SW-40 Audio Out
SW-20 Audio Out
Earphone Jack
Tick Keyer Audio
Freq Mite Audio

up one board when the band switches are set for the other. However, the best procedure is to select the desired band with the two band switches first, then power up the appropriate board with the main power.

When the rig comes on, you will hear the beeps from the Tick keyer indicating that it is on, and a CW "?" from the Freq Mite. If you press the Freq switch right after that, the Freq Mite will send its announcements in the faster of its two CW announcement speeds. If you don't press the Freq switch within two seconds, it sends the announcements in its slower speed. Depending on whether you have used the Tick keyer chip that has mode and speed memory built in, you will need to program it for your desired sending speed.

NOTE:The fine tuning pot should be a better quality one than those currently available from Radio Shack. A poor quality pot used in this configuration will start being erratic after a while, and you will notice erratic movement of the frequency when you adjust the fine tuning knob. If you choose not to modify the SW boards so as to provide the expanded frequency coverage as outlined by Dennis Monticelli, AE6C, and Mitchell Lee, KB6FPW, in their treatise on tweaking the SW series boards in QRP Power, you really don't need a fine tune control. With the normal 40-50 Khz of coverage of the SW series boards, the rate of tuning is fairly slow and it is easy to fine tune a signal with the main tuning knob.

In practice, the dual VFO tune controls are wonderful for tail-ending QSOs by parking one AVFO" on that frequency, switching to the other and doing a band search for other QSOs as desired, and switching back to the first one from time to time so as to know when that QSO is ending and you can make your call.

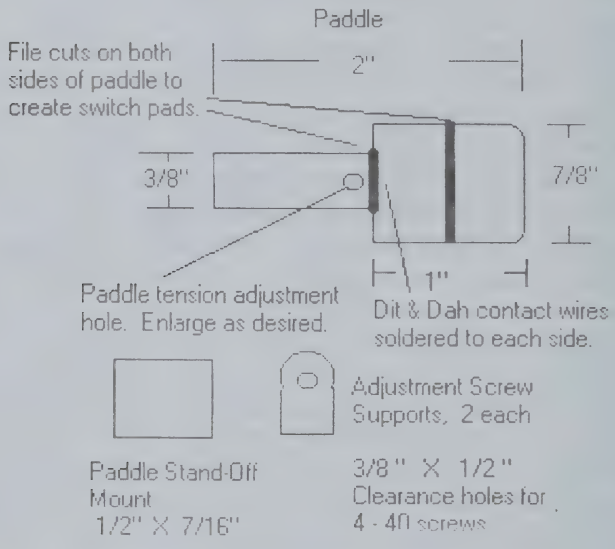
The Keyer Paddle is built right into the front panel of the rig. The details of construction of the paddle are very similar to the methods outlined in a previous article by the author, entitled "The NB6M Paddles", published on the NorCal QRP Club Website, and in the March 2000 QST magazine from the ARRL. Instructions and drawings are included below so that either a single or dual paddle setup can be constructed. I suggest you read the original article first, before starting on this project. It can be read and downloaded from the NorCal QRP club website.

After my article about the NB6M paddles was posted on the NorCal Page, I collaborated with Carel Mulder, PA0CMU, in helping him make a dual paddle. Then Doug Hendricks, KI6DS, took my design a bit further yet with his idea of mounting the adjustment screws for the dual paddles right on the paddles themselves, and made a dual paddle for the Fort Smith, Arkansas, QRP Club kit, the P-Tick. Now I have included

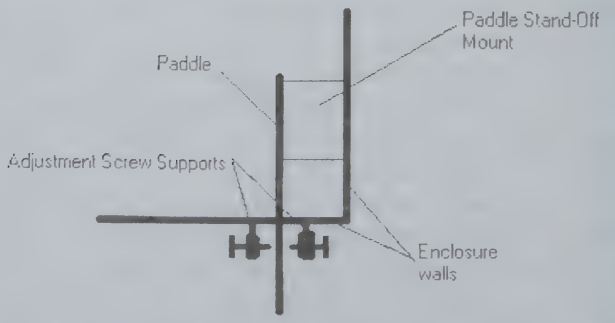
his idea for mounting the adjustment screws on the paddles themselves in my design for a dual paddle setup built right into the rig.

The paddles are mounted on rectangular stand-offs, made from double sided PC Board, that are soldered to the inside of the right side of the PC Board enclosure for the rig. The adjustment screw supports for the single paddle setup are soldered to the front of the front panel of the rig=s PC Board enclosure, and in the dual paddle setup, the adjustment screws are attached directly to the paddles themselves.

In addition to the PC Board parts, you will need two 4-40 X 1/2" Brass screws, four 4-40 Brass

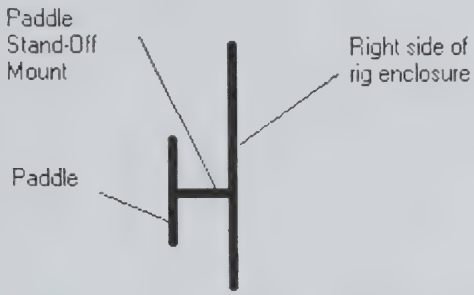


Parts for the single paddle setup



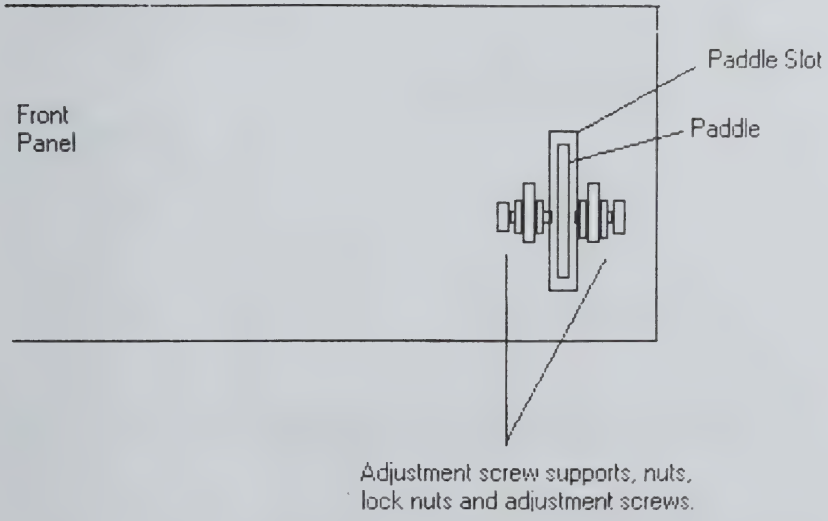
Overhead View: Built in Paddle

nuts, and one 4-40 X 1" Brass screw to help with the installation of the Adjustment Screw Supports.



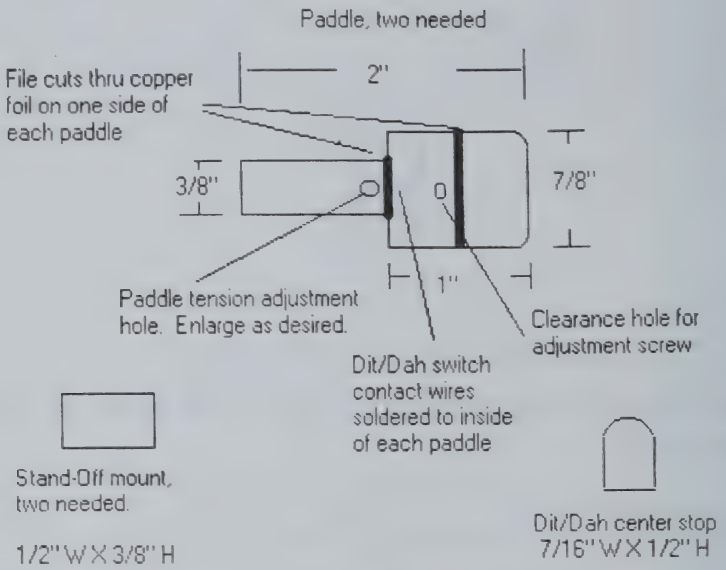
Frontal view of Paddle Stand-Off Mount Details

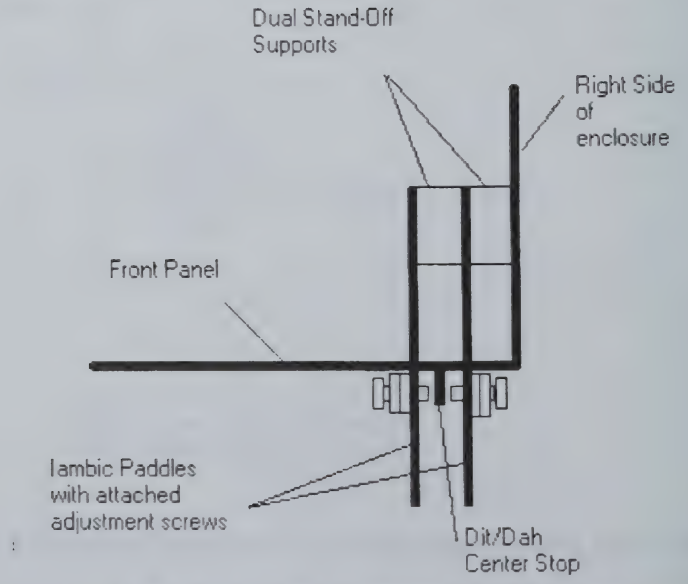
From the front, without the front panel, the single paddle installation looks like this.



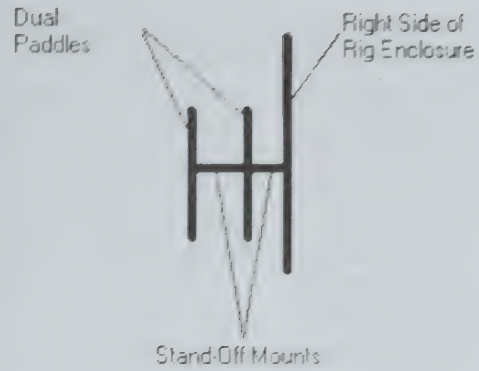
With the front panel installation shown, the single paddle setup looks like this.

Dual paddle parts.
In addition to these PC Board parts, you will need two 4-40 X 1/2" Brass screws, and four 4-40 Brass nuts.



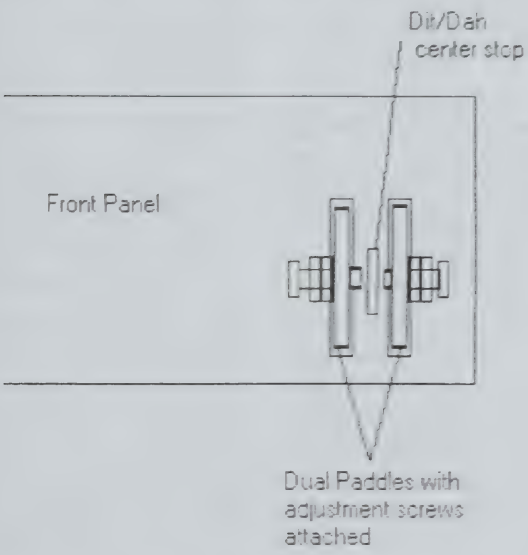


From overhead, the dual paddle installation looks like this.



Dual Paddle Mounting Details

Front view of dual paddle installation without front panel.



The dual paddle setup looks like this with the front panel installation complete.

All of the parts for the keyer paddle setup are made from double sided PC Board. First, draw the individual parts for the paddle setup you desire on a piece of PC Board

Leave the Paddle Stand-off Mount or mounts about a 1/16"

wider than the indicated width so that you can file them to final dimension during the installation process. This will help ensure that each paddle ends up pretty well centered in the slot cut for it in the front panel of the PC Board enclosure. For my single paddle setup, I cut a vertical slot 1/8" wide and 1" tall, centered 1/2" from the right edge, and placed vertically below center because I installed the main power toggle switch directly above it. The individual slot placement depends on the layout of your particular rig.

Drill all the holes in the pieces before sawing the parts from the board. I ended up with a hole about a quarter of an inch in diameter for the paddle tension adjustment, but I suggest you start with a smaller size and use a tapered reamer (Radio Shack) for enlarging it after the paddle is cut from the board and shaped. You could place about a half inch (length of the stand-off support) of the narrow end of each paddle into a small bench vise and try the tension, then enlarge the tension adjustment hole a little at a time until you have the desired amount of tension.

Using a Hack Saw, cut the pieces from the board. Round the corners and smooth the edges of the pieces with a file.

For the single paddle setup, the copper foil is cut in two places on each side of the paddle. This can be done with either the edge of a small file or with a hack saw. Cut just enough to be sure you have separated the copper foil nicely. What you are doing is creating the switch contact pads for the Dit and Dah sides of the paddle. It is necessary to cut the foil in two places on each side of the paddle, as shown in the drawings, so that static electricity and other stray electrical currents from your skin won't cause erratic keying. For the double paddle setup, the cuts are made just on one side of each paddle.

For the single paddle setup, I soldered one 4-40 brass nut to one side of each of the adjustment screw supports, in order to provide the threads for the screws to fit into. You could simply drill and tap (with a 4-40 tap available at any hardware store) the PC board material and use just the lock nuts. However, in the interest of strength and durability, I recommend soldering a nut to each support. For the double paddle setup, one 4-40 brass nut is soldered to the outside of each paddle for the adjustment screws to fit into.

The single paddle assembly procedure is as follows:

First, cut the slot, in the appropriate location for your layout, in the front panel. I did it by drilling a series of 1/8" holes in a vertical line, and then using a small, flat file to shape the slot by removing the material left between the holes.

Then, solder a brass nut to one side of each of the two ad-

justment screw supports. A small board with a hole in it lying on your work table is useful here. Screw a brass screw into a nut and place the end of the screw through the hole in the support and into the hole in the board. This will place the nut against the support with the screw centered in the clearance hole. Solder the nut to the support, let it cool, and remove the screw from the nut. Repeat with the other support.

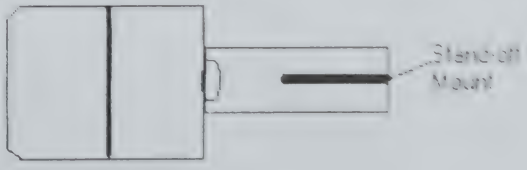
Position the rig so that the front panel is facing up, and is horizontal. Then, position the two adjustment screw supports on the front panel, and solder them into place. The trick to positioning them is to screw a one inch long 4-40 brass screw through both supports, leaving about 3/8" between the two soldered-on nuts, which should be on the inside of each support, facing each other. Use the slot as a guide for placing the adjustment screw supports, as the supports should be on opposite sides of the slot, each one an equal distance from the slot, and centered vertically in relation to the slot. The two supports should be far enough from the slot so that a good, strong bead of solder can be run along the inner joint of the support and the front panel.

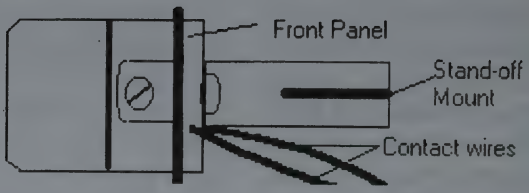
First, tack solder each side of the two supports. This will ensure that they don't move during the soldering process. Then run a good bead of solder along the lower edge of each support.

Once the pieces are tack soldered and you want to run a bead of solder between the two surfaces, which are at 90 degree angles, the trick is to prop the unit up so that the two surfaces form a V, with the apex at the bottom and the two sides about 45 degrees from the vertical. This way, the melted solder will run quite nicely along both sides of the joint, and form a very strong and nice looking connection.

Next, remove the one inch screw from the adjustment screw supports, install the two lock nuts, one on each adjustment screw, running the lock nuts right up to the screw heads, and screw the adjustment screws into their respective supports. Leave a space between the two screws that equals the width of the slot.

Then, lay the paddle flat on your work table and position the stand-off mount so that it's long side is centered in the narrow end of the paddle and the stand-off is vertical in relation to the paddle, as pictured below.





Tack solder one side of the stand-off mount to the paddle, check to see if it is still vertical, 90 degrees to the paddle, tack solder the other side, then run a good bead of solder along both sides.

Now slip the finger end of the paddle through the slot in the front panel, from the rear, with the stand-off mount towards the near wall of the enclosure. Check to see how much material needs to be removed from the stand-off support in order to center the paddle in the slot. Remove the paddle and file material from the stand-off support. File a little at a time and try the paddle, then remove a little more. Pretty hard to put material back on once you have filed it off, so take your time.

Once you are satisfied with the amount of material removed from the stand-off support, solder the two wires for the Dit and Dah switch contacts from your keyer to the back edge of each switch contact on the paddle, as shown in the drawing below. If you are right handed, the Dit wire goes on the right side of the paddle and the Dah wire goes on the left.

Then slide the paddle in through the slot from the rear until the solder joints attaching the contact wires to the paddle are just clear of the back of the front panel and the file cuts separating the switch pads from the touched portion of the paddle are just outside the adjustment screw supports, as shown in the drawing above.

Position the stand-off mount against the side of the enclosure and hold the paddle assembly in place. Screw the adjustment screws in until they are both against the paddle and the paddle itself is centered in the slot. Check to see that the paddle is parallel to the slot, and is parallel to the bottom of the enclosure. Tack solder one side of the stand-off mount to the enclosure, re-check the positioning and alignment of the paddle and tack solder the other side of the stand-off mount. Then, run a good bead of solder along both sides of the stand-off mount.

Now, loosen the two adjustment screws slightly and adjust them for whatever switch gap feels good to you. Tighten the lock nuts to maintain that gap. That=s all there is to it for the single paddle setup.

Double paddle installation:

Cut the two slots in the front panel of the enclosure in the locations you desire. The actual spac-

ing of the paddles in terms of the distance from the near enclosure wall and the distance between paddles is up to you, depending on your layout and the paddle spacing you desire.

Then, draw the parts on the PC Board. Drill the holes before sawing out the parts, just as we did for the single paddle setup. Make the tension adjustment holes in the two paddles smaller to begin with, about 1/8", and enlarge them as desired after the parts are cut out. For the double paddle setup, you need adjustment screw clearance holes and tension adjustment holes in each paddle.

Make the two Stand-off Mounts wider than specified initially, so they can be filed to finished dimensions to match the spacing of your two slots in the front panel. The stand-off mount which goes between the wall of the enclosure and the nearest paddle is made initially just wider than the distance from the wall to the center of the closest slot. The stand off mount that goes between the two paddles is made initially just wider than the distance between the centers of the two slots.

Although a dimension is specified in the drawing for double paddle parts, the actual distance between paddles and the distance between the paddles and the enclosure wall is up to you and the stand-off mounts are made accordingly.

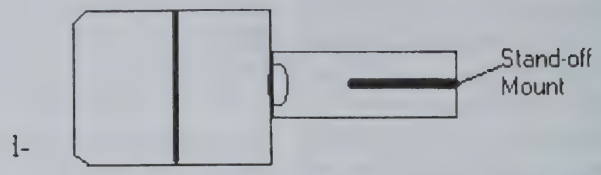
Saw out the parts with the hack saw, smooth the edges with the file, and make the two switch pad cuts on one side only of each paddle. This will now be the outside of each paddle. Drill the tension adjustment holes and the screw clearance holes. After drilling the clearance hole for the adjustment screw, use a countersink bit to remove a little copper foil from around the hole on the side opposite the switch pad (inside surface). Otherwise the switch pad will be grounded all the time by the screw. Make your adjustments to the size of the tension adjustment holes in the two paddles. Try to get the tension as close to equal in the two paddles as possible.

Position the rig so that the front panel of the enclosure is up, and is horizontal with your work table surface. Position the Dit/Dah Center Stop between the two slots, parallel to the slots and centered between them, perpendicular to the surface of the front panel. See the drawings of the double paddle setup for further clarification if needed.

Tack solder one side of the Center Stop, check its position, and tack solder the other side. Then, run a good bead of solder along both sides of the Center Stop, making a good, strong joint with the front panel.

Now, lay one paddle flat on your work table, with the switch pad file cuts UP, and position one Stand-off Mount centered in the narrow end of the paddle, perpen-

dicular to its surface, as pictured below.



Tack solder one side of the stand-off mount to the paddle, check its position, and tack solder the other side to the paddle. Then run a good bead of solder along both sides of the joint.

Now slip the finger end of the paddle through the slot in the front panel closest to the side wall of the enclosure, from the rear, with the stand-off mount towards the near wall of the enclosure. Check to see how much material needs to be removed from the stand-off support in order to center the paddle in the slot. Remove the paddle and file material from the stand-off support. File a little at a time and try the paddle, then remove a little more. Pretty hard to put material back on once you have filed it off, so take your time.

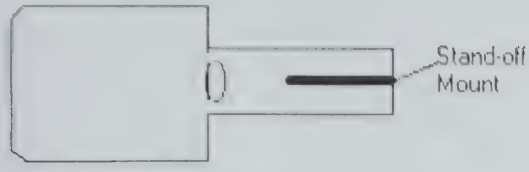
Once you are satisfied with the spacing of the paddle in the slot, solder either the Dit or Dah contact wire from your keyer to the back edge of the switch pad, just in front of the tension adjustment hole in the paddle. The selection of Dit or Dah wire will depend on which hand you normally use the paddle with. If you are right handed, this will be the Dah contact.

Then slide the paddle in through the slot from the rear until the solder joint attaching the contact wire to the paddle is just clear of the back of the front panel, and the file cut separating the switch pad from the touched portion of the paddle are just even with the outermost edge of the Dit/Dah Center Stop. There needs to be enough space between the clearance hole for the adjustment screw and the front panel so that when you solder a 4-40 nut in that location it will clear the front panel.

Position the stand-off mount against the side of the enclosure and hold the paddle assembly in place. Check to see that the paddle is centered in the slot, that the paddle is parallel to the slot, and is parallel to the bottom of the enclosure. Tack solder one side of the stand-off mount to the enclosure, re-check the positioning and alignment of the paddle, and tack solder the other side of the stand-off mount. Then, run a good bead of solder along both sides of the stand-off mount.

Now, lay the other paddle flat on your work surface, with the switch pad file cuts DOWN and

position the other Stand-off mount as you did with the first paddle, and as pictured below.



Tack solder one side of the stand-off mount to the paddle, check its position, and tack solder the other side to the paddle. Then run a good bead of solder along both sides of the joint.

Slip the finger end of the second paddle through its slot in the front panel, from the rear, with the stand-off mount towards the first paddle. Hold the second paddle's stand-off mount against the first paddle and check to see how much material needs to be removed from the stand-off support in order to center the second paddle in the slot. Remove the paddle and file material from the stand-off support. File a little at a time and try the paddle, then remove a little more. Pretty hard to put material back on once you have filed it off, so take your time.

Once you are satisfied with the spacing of the paddle in the slot, solder the other contact wire from your keyer to the back edge of the switch pad, just in front of the tension adjustment hole in the paddle. If you are right handed, this will be the Dit contact.

Then slide the paddle in through the slot from the rear until the solder joint attaching the contact wire to the paddle is just clear of the back of the front panel, and the file cut separating the switch pad from the touched portion of the paddle are just even with the outermost edge of the Dit/Dah Center Stop. As with the first paddle, there should be enough distance between the clearance hole for the adjustment screw and the front panel so that when you solder a 4-40 nut in that location it will clear the front panel. Also, the outer end of the second paddle should be even with the outer edge of the first paddle.

Position the stand-off mount against the first paddle and hold the paddle assembly in place. Check to see that the paddle is centered in the slot, that the paddle is parallel to the slot, and is parallel to the bottom of the enclosure. Tack solder one side of the stand-off mount to the first paddle, re-check the positioning and alignment of the paddle, and tack solder the other side of the stand-off mount. Then, run a good bead of solder along both sides of the stand-off mount to form a good, strong joint between it and

the first paddle.

Now screw two brass nuts onto an adjustment screw, running one of the two right up against the head of the screw and positioning the other nut about 3/16" from the end of the screw. Install two nuts on the other adjustment screw in the same fashion.

Turn the rig onto one side, so that one of the paddles is horizontal, parallel to your work surface. Place one adjustment screw assembly into the clearance hole in the upper paddle as pictured below, and solder the lower nut to the paddle.

Turn the rig over so that the other paddle is up and horizontal, parallel with your work surface. Place the other adjustment screw assembly in position, and solder its lower nut into place on the paddle. Once both adjustment screw assemblies have cooled, adjust the spacing for the Dit and Dah contacts with the adjustment screws, and, when you are happy with the spacing for each, tighten the lock nuts.

Whether you like the single or double paddle version, you can build a very nice keyer paddle right into your rig. Best of all, it can be modified to fit into whatever rig you want, and can be built to suit you, in either style.

Given the choices of monoband transceiver boards there are available today, you can select two of a design you like, for whichever bands you desire, and, with this scheme, build yourself a very nice two band, QRP sized, CW rig. For that matter, you could use this same switching configuration to build a two band QRP SSB rig with a couple of the small boards available today. This scheme can be used with any pair of transceiver boards that use pots and varicaps for VFO tuning. And, although the DSW series is now out of production, the SW+ series is still available.

Enjoy, Wayne NB6M

Operating QRP: It's a Contact Sport!

by Michael A. Gipe K1MG
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Introduction

Attention sports fans! QRP is NOT for sissies. It's a contact sport, and I'm not talkin' about QSOs. It's sprained wrists and ringing ears. If you're not prepared for QRP, it's like:

Playing football without a helmet;
Climbing Mount Everest with-

out oxygen;
Playing baseball without a glove;
Or playing tennis without tennis shoes.

Imagine an English football player stepping into an American football game, and you can imagine what it's like for a QRPer to set foot on the bands full of 2kw DXers and monster contest stations.

A QRPer has to be smarter, faster, and lighter on her feet. If you want to operate QRP, you've got to be in top condition – better prepared than the rest.

QRP is the ultimate proving ground for equipment and operator skills. Whatever the reason you choose to operate QRP, it is sure to provide more challenges, better training, and more fun than QRO. But you'd better be up to the challenge, and that means mastering the operating skills, choosing the right equipment and knowing how to use it properly, getting in condition, practicing, and having fun while doing it. Let's check out what it takes to be a real QRPer.

Personal Conditioning

Operating QRP is a sedentary sport, right? It's about as strenuous as watching a football game on TV while relaxing in your Lazy Boy with a brewski, right?

Ask any contester how he feels on Sunday night after a weekend contest. After all, a marathon runner gets to stop running after four to six hours, but a ham radio contester has to keep going up to 48 hours with little rest. His voice or wrist is working the whole time, and he must be alert and quick in the stressful world of competition. His body is tense and poised at the key or mike for hours. He must maintain concentration without sleep. His bio-rhythms are completely disrupted. The QRP contester must work harder and concentrate more to keep his QSO rate up. Contesters suffer from hand or wrist fatigue, a worn out voice, and strained hearing.

One favorite activity of QRPers is carrying their radio stations out to the wilderness, where they can combine the fun of radio operating with hiking and camping. Besides the usual challenges to the body that these activities represent, the QRPer will be carrying radio equipment, heavy batteries, and an antenna in his pack. When the campsite is reached at the end of the day, he still has to erect the antenna.

One of the greatest challenges to the safety and health of an avid QRPer is the Family Hazard. If you are putting in the time to make a serious effort at QRP foxhunting, for example, your family may resent the time you spend at the rig. Family members may not realize how difficult contesting can be with interruptions, even short ones. And your family may not appreciate all the noises emanating from your radio while you chase DX at 3:00 AM. Being a QRPer and a responsible family

member requires proper balance.

Of course, we are all aware of the physical dangers of doing the QRP-L Fox Happy Dance without being in good physical condition.

All of which means that you've got to be in top physical shape to be a QRPer. Proper conditioning, preparation, and training are mandatory. Before that contest, strive to get in shape with a little daily exercise, plenty of sleep, a healthy diet, and a good dose of vitamins. You can't do your best in the Sweepstakes if you are tired, rundown, and loaded down with too many MacDonald's french fries. During the contest, take advantage of the rules concerning operating times to schedule frequent stretch breaks. Get out of the shack, move your body, and relax your mind for half an hour. The result will be better run rates and fewer busted calls in the log. Overcome the temptation to snack on potato chips and sodas during the test. Emphasize complex carbs, fruit, finger vegetables. Avoid excessive caffeine intake. You may need to keep the coffee pot going to manage to stay awake, but, for the sake of your fellow hams, try to avoid the overcaffeinated paddle syndrome, where your keying is so shaky that none of us can copy what you send. Protect your ears from fatique by keeping the volume low, using AGC, and periodically shifting the sidetone frequency. Try switching filter bandwidths from time to time to change the tonal character of the noise. To protect your voice, keep the humidity up and the temperature comfortable.

Before you set out from the trail head, consider carefully what you bring along. Scale down your ambitions for radio operations and vow to enjoy the hike, rather than swear at your pack all the way up the trail. Be aware of altitude sickness and how to treat it, including slowing your pace, drinking lots of water, and taking Tylenol. The best way to avoid altitude sickness is to plan your trip so that you have several days at intermediate altitude to acclimate your body before the hike. Choose the equipment you carry wisely. There are many trail-friendly QRP rigs available which are light-weight and easy on your batteries. Batteries are usually the heaviest part of the backpacker's station. Take time to calculate your power needs and choose the smallest, lightest battery solution that satisfies the requirements. It's also a good idea to divide your battery capacity into two sets, so you have a backup in case of unexpected discharge or failure of one set of batteries.

Remember that the amateur is balanced, and take your family's needs into consideration. Make a deal before the contest; in exchange for their promise of allowing you uninterrupted time to work the full contest, you will eschew ham radio for a full weekend to devote yourself to family activities. Be considerate, and arrange for quiet operation during the times

when normal people sleep. Perhaps the most effective way of maximizing your operating options is to become a retired widow or widower. Before you object, claiming limited finances, too young to retire, or healthy spouse, consider a high payout life insurance plan for your spouse. If you only need to pay the premium for a few months before becoming a wealthy early-retired widower, the cost is much less than a tower and tribander, and your country count will rise much faster. Just kidding, of course, but remember to take the time to enjoy your family before you become a retired widow with a country count over 300, with no one to talk to at home, and no memories to fall back on.

Work on improving your code copying speed. When the signals are weak, and the static crashes loud, you have an extra advantage when you are just loafing along speed-wise.

Whichever ham radio activity you enjoy best, doing it with QRP is more challenging and rewarding.

QRP operation can be hard on the body. It requires concentration and attention to copy weak signals in the noise. Keep your heart, hands, ears, and voice in good shape. And don't forget to practice that happy dance! You'll be glad you did.

Equipment

Many people enjoy QRP because of the simplicity of the equipment that you can use. It is certainly a thrill to work stations across the country using a one-transistor rig that you just built. If you are going to wholeheartedly embrace QRP for all your ham radio activities, however, you need to carefully choose the equipment you use in order to get maximum satisfaction.

There is certainly no need to go out and buy an FT-1000 to be successful at QRP. In fact, although the Yaesu FT-1000 can be an excellent QRP rig, many standard HF rigs are not as good for QRP operation as some of the less expensive radios that you can buy or build that are specifically designed for QRP operation. Certainly, the concept of KISS (Keep It Simple Stupid) applies to QRP. Rather than choose a transceiver or antenna that has all the features, bells, and whistles, it may be best to select the transceiver with the specific features that are most useful for the kind of operating you intend to do. I've compiled a guide which lists some of those features and the ham activities that need them. Of course, these are my opinions, and you may have different ways of operating, so feel free to modify these based on your own experiences.

Some of my choices may require a little explanation, so let's examine the features of QRP rigs as they apply to various operating activities.

Rag Chewing

This is probably the most popular activity of the fraternity of

QRPers. Perhaps the best part is that you can do it and have a lot of fun with almost any QRP or QRO rig, from Pixie to FT-1000. About the only features that are absolutely necessary are the ability to receive and transmit, and a fairly stable VFO. Of course, your operating time will be more fun with a few additional options. The first thing you will appreciate is a good low-noise receiver. This means a receiver with a sensitive front end with a low noise figure. When the signals are weak and barely above the atmospheric noise, you don't want your receiver to add additional noise. Many commercial HF receivers are designed with the assumption that high natural noise levels, especially at the lower frequencies, will dominate the communications path; therefore it is not necessary to design a low noise front-end. This is probably true for most ham communications at 100 watts. However, QRPers tend to take advantage of those opportunities when the sun, our ionosphere, and the weather are cooperating to give us lower than average atmospheric noise. If your receiver is generating its own noise, you won't be able to take advantage of the opportunity. Phase noise, which is often the result of poorly designed frequency synthesizers, contributes to the total internally generated noise of a receiver, but it is of lesser importance for casual ragchewing than in other kinds of operation because its main contribution to in-band noise occurs when the frequencies surrounding your QSO are filled with strong stations.

One often neglected part of the ragchewer's QRP station is the antenna. Although there are many adherents to the philosophy that QRP must mean poor antennas, I am strongly of the opinion that the QRPer should make the effort to assemble the most efficient and effective antenna system he can. QRP is about low power communication, not wasting power. This doesn't necessarily mean that you need to go out and spend thousands of dollars erecting a monstrous tower and beam. In fact, for reliable QRP operation, your money may be better spent on several simpler antennas and a switch to select the one which provides the best performance for the current QSO. While the DXer, intent on raising his country count, may be wise to invest in the tallest tower and biggest twenty-meter yagi he can find, the QRP rag-chewer will probably be happier with a couple of wire antennas, placed high and in the clear, that he can select based on band conditions. At K1MG, I do have a tower and beam, as well as a vertical and G5RV. There are times when the G5RV outperforms the beam, and is the better choice for the QSO. We often forget that a non-resonant simple wire antenna, matched to the transmitter with a low-loss tuner, usually has a radiation pattern with multiple lobes

and nulls, and an equally complex elevation pattern. Although the nulls certainly make communications in certain directions difficult, the lobes can often provide gain which exceeds that of a decent yagi. My G5RV has a nice lobe in the direction of Arizona, as several members of the SQRPions can attest, which makes it the better choice when I want to trade stories with my friends there.

For rag-chewing, full break-in (QSK) operation is a nice feature to have in a transceiver. Certainly you can have lots of fine QSOs with a toggle switch for changing from transmit to receive and back again, but QSK adds another dimension. It adds to the conversational quality of a QSO, allowing the quick back-and-forth patter of a face-to-face conversation. You can interrupt and respond immediately when the other operator asks a question. It also allows you to immediately recognize when that high-power RTTY station starts up on top of your QSO, so you can quickly QSY without losing the flow of the conversation. It can also save you from unneeded stress, such as might result from a need to heed the call of nature during your QSO partner's long-winded monologue. In fact, QSK allows you to change the subject when you get bored with that long-winded monologue!

RIT is another useful feature to have in the radio you use for casual rag-chewing. QSOs most often start when someone calls CQ, and that person may have been you. If the reply to your CQ is not exactly zero-beat to your frequency, you may need to tune your receiver for best reception. However, you do not want to change your transmit frequency or you risk losing the other station, or you both end up leapfrogging down the band. RIT (receiver incremental tuning) allows you to tune your receiver in the vicinity of your transmit frequency, so that you can center your QSO partner in your receiver filter.

In the true spirit of QRP, many ops like to reduce power to the minimum necessary to comfortably maintain communications, so a transmitter with adjustable output power is a nice feature, though it is certainly not required. Along the same lines, an effective AGC system in your receiver is not required, but certainly makes operating more convenient. However, if you don't have AGC, you still have plenty of time in a rag chew QSO to manually set the RF and AF gain for best operation, even QSY if necessary when that kw station down the street comes on a few kilohertz away.

Contests

You will find that the best station for contesting is quite a bit different from the ragchewer's station. Here, the QSOs are fast and furious, the bands are filled with lots of stations, many of them QRO, and they are located on all points of the compass. The demands on your station are tougher.

The first accessory you need to add to your contest station is a UTC clock. Whereas your wristwatch set to local time may be all that you need to properly log your casual contacts, you need accurate UTC at hand to know when the contest begins and ends, and each contact must be accurately logged to count in your total score.

Your antenna system should allow you to make contacts in any direction. Here is where that high-gain yagi may be a big disadvantage. You are better off with several switchable wire antennas or an omnidirectional vertical antenna. An electronically switched phased vertical array may be the best contest antenna, since it gives you gain, reduced QRM off the back, and nearly instant changes of direction.

In your receiver, you will appreciate having a crush-proof front end and effective AGC. There will be a lot of very, very strong signals close to your frequency, and you don't have time for repeats or the ability to QSY to avoid them when they wipe out your receiver with poor dynamic range. Many QRP-only rigs have poor dynamic range, especially simple radios that use inexpensive low power first mixers like the NE602. Better receivers like in the NorCal 20 use better mixers and consume more power. AGC is used in these receivers to control the signal levels throughout the signal path so that the linear operating region is not exceeded when strong signals are encountered. Tight filters are very useful for both SSB and CW contests, since stations will generally be packed into the band like sardines in a tin can. Low phase noise is a must. This is where many single band QRP rigs perform better than the commercial YaeKenCom rigs. Phase noise is the result of slight instability in an oscillator, and can be seen on a spectrum analyzer as wideband noise whose amplitude decreases as you move further away from the oscillator's main frequency output. Well designed oscillators with high Q tuned circuits exhibit less phase noise. A phase locked loop can reduce the phase noise of a less stable VCO; however, the VCOs and PLLs of many frequency sythesized transceivers may have higher phase noise than a well-designed narrow frequency VFO such as may be found in some single band QRP transceivers. Since the main frequency and the phase noise of a local oscillator both mix with incoming signals to produce an output at the receiver IF frequency, signals on the band that are many kHz away from the station that you wish to hear are also converted by the phase noise to the IF passband, albeit at a lower level proportional to the level of the phase noise. On a crowded band, the net effect is to raise the level of noise in the passband, possibly masking low level desired signals. In other words, if your receiver has poor phase noise performance, during a contest the

band will sound very noisy and many of the weaker signals will be wiped out by that noise.

Full QSK is almost a must in a CW contest. The exchanges are fast and furious, and there is no time to wait for slow T/R switching. You may be able to get by with fairly fast partial break-in operation. For SSB contests, a foot switch frees up your hands for logging and is faster than VOX. A memory keyer can save your wrist by freeing you from sending the contest exchange over and over again. Of course, you may wish to upgrade to full computerized logging and sending for the most efficient contest operation.

To the Field!

Setting up a radio station away from home captures the interest of many hams, which explains why the ARRL Field day, QRP to the Field, and QRP Afield operating exercises are some of the most popular contest-like operations in the hobby. Without a doubt, the one most important element of your field station is the battery. Without a proper battery or with an inadequate battery, your operation will not be successful. On the other hand, carrying too large a battery to a remote site can be seriously hazardous to your health. Years ago, I used to carry a full size, marine deep cycle, lead acid battery to our field day sites at the beach or in the hills. In the years since, batteries seem to have gotten heavier and I have gotten smarter, so I now prefer lower power and small gel cells or nicad batteries. Nearly every field station needs a battery, even if it is only used to supply the peak transmit currents which your solar or wind generator can't handle. Take the time to calculate exactly how much battery capacity you will need for your planned expedition, and be sure to take into account the weight of the batteries that you must carry into the field.

Of course, even a lightweight battery is no good if the radio itself is too large or heavy to carry, or if it consumes too much battery power during receive. Although many commercial radio manufacturers have introduced small transceivers like Icom's pioneering IC706, these all consume a lot of current even while receiving, perhaps as much as half an amp from your 12 volt battery. Compare this with some of the QRP rigs designed by N6KR, NN1G and others for field use. Some of the more efficient of these use only 0.025 amps during receive. Since the majority of your time on the radio is spent receiving, an efficient receiver can save a lot of battery weight. Usually, in order to achieve low receiver current, you must compromise dynamic range, but in field operations away from populated areas, this is much less important.

Your field antenna should be easily broken down and carried as well as light in weight. Wire antennas are generally the rule except for a few overambitious Field

Day club stations. Trees provide excellent support for such antennas if they are around and you have brought along a means for stringing the support ropes high up in the trees. Sling shots, bows, and weighted heaving lines have all been used successfully, as well as the occasional spud cannon. What if your hike takes you to a treeless place? Be sure to bring an antenna support with you, too. Lightweight collapsible fishing poles can often used to support a horizontal or vertical wire antenna. One of the nice advantages of field operation is the ability to pick an excellent antenna site, taking advantage of altitude or terrain to make a simple and inexpensive antenna outperform a monster home station antenna. One more point to remember is that resonant antennas can save weight by eliminating the need for a tuner.

Once you have reached your destination, you won't want to return to pick up supplies or equipment that you forgot, and you certainly don't want to carry unreliable equipment. So before you leave, check out all your equipment that you intend to bring, making sure that you have safely packed all the cables, connectors, and other accessories needed to operate. Provide a secure means of carrying the batteries so that there is no opportunity to short their terminals. Test your transceiver so that you know how it behaves as the battery reaches the end of its charge. Will the rig become unstable below eleven volts? Will it operate down to ten volts with lower power out? Test everything beforehand, pack it up, then leave it alone until you are ready to leave.

Generally, most field operation takes the form of either contest style operation or rag chewing/keeping in touch with home. You can tailor the station to fit the needs of the intended operation, but the requirements for low total weight and reliability are paramount.

DX Pileups

Avid DXers can't resist them; even non-DXers find themselves drawn to a massive pileup on top of a rare country. Do you need to invest thousands of dollars in your station to be able to play in the pileup? No, what you need is fine-tuned operating skills and a few special equipment features. The most important thing you need for pileups is the ability to operate split frequency, where you transmit on a frequency different from where you are listening. This is sometimes referred to as dual-VFO operation. Most of the time the DX transmits on one frequency and listens for responses over a range of frequencies above his transmit frequency. This keeps the pileup from covering up his transmissions. This is common practice for both SSB and CW operation. If you don't have the ability to separate your transmit and receive frequencies, you will probably be unsuccessful at making a QSO at best, and branded a LID by the

other stations at worst. Split operation permits you to park your receiver on the DX station so you can always hear him, then move your transmitter to where he is listening. It also allows you to quickly swap frequencies so that you can listen to the other stations working the DX and check out your own transmit frequency to make sure it is reasonably clear. Some high-end commercial transceivers allow you to operate with two receivers simultaneously, one glued to the DX station, and one tuning around for the best spot for you to transmit. Generally, each receiver feeds one ear, so you can keep them straight. Unfortunately, most QRP radios do not have split operation available. You can make do with RIT or XIT in this case, but it is much more difficult. XIT is more useful, and the ability to quickly switch between RIT and XIT is very helpful. Hopefully, the development of more sophisticated QRP transceivers such as the Elecraft K2 and the adoption of recent technologies like DDS (direct digital synthesis) will make split operation more common in QRP radios.

Besides split operation, your radio should have a pretty rugged front end, with good dynamic range and effective AGC. After all, the combined power of a pileup is probably close to a megawatt! Full QSK will save you from embarrassment from transmitting at the wrong time. Most DX ops work through a pileup quickly, and you can't wait for a sluggish T/R changeover.

Narrow bandwidth filters are usually not necessary, since most operators are careful to stay clear of the DX's transmit frequency where you are listening. A good UTC clock will be helpful, since you don't get a QSL if you logged the time wrong. Many DX stations, especially DXpeditions, have good antennas and operate at fairly high power, so the demands on your receiver are fewer.

For your antenna, put up the best, most efficient, single antenna you have space and money for. For the diehard DXer, this usually means a tall tower and big yagi, but simple antennas can work too. Verticals are good due to their low take off angle. However, it is important to make your antenna system efficient – every watt lost in poor feedline, an inefficient tuner, corroded connections, or an inadequate ground system reduces your success.

QRP-L Foxhunt Pileups

It has been said that the QRP-L foxhunts are excellent training for chasing DX. I think that DX pileups are excellent training for the foxhunt. After several years of foxhunting, the hounds have gotten smarter and more skilled than the everyday DXer in a pileup. However, the equipment requirements are much the same, with only a few minor differences. You can get by without split or RIT/XIT because all the foxes will work a considerate operator who is

zero-beat with their signal. Because of this, you may find you need some tight filters to be able to separate the fox's signal from the hounds. In addition, sometimes a wide filter helps to copy a weak fox because your brain and ear can perform some pretty miraculous signal processing to pull a signal out of the noise if it has a full bandwidth signal to work with. For the antenna, you may find that having two simpler antennas is better than one high-performance antenna for the simple reason that the foxes are spread across the country and you may need to pick the antenna which best matches the propagation conditions during the hunt. I once worked a fox who could only hear me when I was transmitting on my horizontal dipole, but I could only hear him on my vertical. It made for some pretty complicated changeovers, but having both antennas available made a QSO possible. Don't forget, full QSK is necessary if you want to avoid the embarrassment of stomping on the fox's toes.

Operating Smarter

The key to QRP success is to operate smarter. By using our finely developed skills and keen minds, we can play the game surrounded by kilowatts and not only survive, but thrive. Half of operating smarter is just common sense; the other half is learning and using the skills and techniques that have been developed over the years by A1 operators. Did you ever wonder how something as uncommon as common sense got its name?

Like any sport, QRP requires a combination of skills, knowledge, equipment, and attitude in order to excel.

Skills

The topic of operating skills for QRP operation is so big that you could write a book about it. In fact, somebody already has. In my opinion, *the* training manual for QRPers who want to improve their skills for rag chewing, DXing, contesting, fox hunting, and having fun in general is Bob Locher's book, *The Complete DXer*. A book on DXing? Yep. I reread my copy often, and never fail to learn or relearn some good lessons. Get it. Read it. Do it.

One of the most fundamental axioms of operating is that you must be transmitting on the frequency where the other station is listening. Sounds pretty simple, doesn't it? If his receiver isn't tuned to your transmit frequency, he won't hear you, regardless of your power output or antenna gain, or even an intense need to get a QSL from his country. Certainly, only an idiot would attempt to initiate a QSO by transmitting where the other station was not listening, but actually it happens all the time. First, you have to figure out where his receiver is tuned without standing behind him and looking over his shoulder at the control panel on his transceiver. Next you have to figure out how to place your transmitted signal at that same fre-

quency. Let's look at these jobs one at a time.

How can you tell where his receiver is tuned? We can only make an educated guess, of course, but the more education we have, the better the guess. First off, most QSOs between two stations occur or ought to occur on one frequency, with each station transmitting and receiving on the same frequency. So if you hear a station calling CQ, chances are good that he is listening on the same frequency that he is transmitting. Of course, there is always the possibility that he left his RIT on accidentally, or has somehow mistuned his transceiver, or not properly spotted his transmitter to his receiver. If he is just finishing up with a QSO and you want to call him, you can adjust your transmitter so that you exactly zero-beat (set to the same frequency as) the other station he was talking with. You can be fairly certain that if he was copying him during the QSO, his receiver will be set to that frequency. Let's say that you can't hear the other station, or he has just come up and called CQ, and you were unsuccessful at getting his attention by calling on the frequency you expected him to be hearing. Instead of concluding that your QRP signal is too weak and giving up, try shifting your transmitter up or down a couple hundred hertz and trying again. Occasionally, you may come across a station using a very simple QRP transceiver which does not have a built-in transmit offset such as the Pixie or 49er. In this case, calling him approximately 600 Hz above or below his transmit frequency may catch him. The point is, before you give up, make sure you have exhausted all the possible reasons why he might not be listening to the frequency of your transmitter.

Desirable DX stations, foxes, and some special event or contest stations may be working an offset. This means that the station is intentionally listening and working other stations at a frequency substantially different than his transmit frequency. Usually he will let you know this by adding the phrase "up 2" or "up" on CW, or "listening 14200 to 205" on SSB. If you go to the indicated frequency, you will most likely encounter a nice big pileup. Tune around the pileup and listen for a while. If it is for a rare country, you will most likely hear several stations calling on the DX's frequency, and a whole bunch of stations calling in a swath of frequencies five kHz wide or more. If the rule is, call the station where his receiver is tuned, then why are these people transmitting over such a wide range? If everybody followed the rule, everyone would be stacked on top of each other on the same frequency where the DX's 100 Hz receive filter would pass it. Fortunately for the QRPer, most people go the lazy route and try to substitute brute force and repetition for smarts. This is where

the smart QRPer has the 10 S-unit advantage over a kilowatt! If your one watt signal is centered in the DX receiver passband, and the 1.5 kW signal is 2 kHz lower, which one of you will get the QSO? What does the smart QRPer know about the DX's receiver that all those other people don't know? You know where he's tuned because you've listened and figured it out. The first conclusion you make is that his receiver was just tuned exactly to the frequency of the guy he just finished a QSO with ("K1MG 599 tu"). I assume at this point that you have set your transceiver to split or XIT, and you have centered the receiver on the DX station with VFO A. Never change that setting. Now swap VFOs or switch XIT to RIT, and tune around to find the lucky DXer finishing up his QSO ("tu ur 599 de K1MG/QRP"). If you now swap VFOs or switch RIT to XIT, you have about an 80% chance of hitting him right between the skirts of his filter. For the other 20%, you have to listen a little bit more to find his pattern of receiving. Listen some more and keep searching for the stations he calls. Some DX stations run a pattern through the pileup, the most common being to tune up a little between each QSO until the top of the pileup is reached, then starting again at the bottom. Another common pattern is to alternate two frequencies. If you can figure out his pattern, you will be one of the few people in the pileup who know where he will be listening for the next QSO, and you can just drop your call on that frequency and collect your prize, I mean QSO. Of course, there are refinements and more advanced techniques, but the whole goal is to put your signal where the other guy is known to be listening. Instead of jumping into a pileup and calling blindly for twenty minutes, try listening carefully for fifteen minutes and making one call to grab the QSO!

Naturally, all this attention to figuring out where the other station is receiving is just wasted effort if you don't know how to set your transmitter to that frequency. This is known as zero-beating the station. The name came from the era where receivers had adjustable BFOs, and you could set the BFO to the center of the IF filter passband. Then you tuned your receiver so that the tone of the station calling dropped to zero cycles per second. Finally, you tuned your transmit VFO to the same zero frequency tone. If it was a little off of the other guy's frequency, his signal and yours would mix or "beat" together to produce a slow pulsing sound. If you tuned the VFO so this pulsing slowed and stopped, you were zero-beat with the other station. With most modern transceivers, the BFO is fixed so that a specific tone is generated when the signal is centered in the passband of the filter. The transmit VFO is automatically offset exactly the right amount to match this. The key-

ing sidetone generated locally by the transmitter is set to this same frequency. All you have to do is tune the other station in so that his signal has the same pitch as your keying sidetone, and you are automatically zero-beat. Although most transceivers do this, a few, particularly simple rigs like the Pixie or 49er, do not. Therefore you must know how your rig works and know how to zero-beat it a signal correctly.

The corollary to transmitting on the frequency where the other station is listening, is to call the other station *when* he is listening. Again, this sounds stupidly simple, but folks violate this rule all the time. How often have you been dismayed because you couldn't copy the DX station or the Fox because somebody else was busy repeating his own callsign over and over on top of him? Simply stated, when the Fox or DX is transmitting, he is not going to be listening to anybody! The smart QRPer listens long enough to get into the rhythm, always stops transmitting when the other station starts, and times his own calls to the exact time the station is listening. Of course, you are using QSK so you can tell if the DX starts transmitting while you are still sending, right? To catch a fox, you need to tune your timing to the milliseconds, so stay alert and practice.

The most important skill a QRPer can have is listening. Listen to learn. Listen to the pileups to find out what successful stations are doing to be successful. Listen to figure out how the propagation is changing on a band. Listen to find those lonely DX stations that are calling CQ 10 kHz away from the awful pileup at the bottom of the band. Listen to find out what you can about the station you want to contact. Just by listening to the string of "599 tu's", you can sometimes figure out what equipment he is using, what kind of antenna he has, and a whole host of useful facts. Every transmitter has a characteristic sound and every operator has a distinctive fist or voice that you can discern by careful listening. I was once hunting a distant and weak fox, and having a difficult time making myself heard above the hordes of Texan hounds. At one point, the fox was forced to QSY because of sudden RTTY QRM. He made a quick announcement that he was QSYing and disappeared. I quickly tuned up to a quiet spot where I thought he might land, and listened while a weak station sent "QRL?" I recognized his fist, and caught the pelt before he identified and before anyone else knew he was there. There are lots of things you can learn by listening, things you can then exploit to give yourself an advantage, whether you are trying to overcome the roar of a pileup, the inexperience or nervousness of a brand-new ham, the ravages of QSB on your puny signal, or Murphy's tricks.

While we're on the topic of skills, let's not forget the basics.

When the going gets rough, and the band is noisy, that extra practice to raise your code speed will help. If your brain is coasting along with the code, it can concentrate on pulling the dits and dahs out of the noise. If you know the common CW procedures and abbreviations, they won't throw you for a loop while you dig that weak one out. If you know how to use all those buttons and knobs on your transceiver without thinking about it or referring to the manual, your operating will be easier and more fun. If you learn the distinctive sounds of signals undergoing the strange process of around-the-globe propagation, if you learn what 40 meters sounds like when it is about to "go long", if you teach yourself to copy lousy fists or exaggerated swings, you'll get a lot more enjoyment from the hours you spend at low power.

There are a lot more tricks and techniques, but I have to save a few for myself when I come up against you in the fox hunt!

Knowledge

In the thirty-plus years since I was first licensed, scientists have amassed a wealth of knowledge about the sun and how it affects radio wave propagation on earth. What was once a vague concept of correlation between the number of sunspots and the frequencies that the ionosphere reflected has turned into a fairly well-understood system of cause and effect. These days, you are as likely to hear QRPers talking about CMEs and geomagnetic disturbances and M-class flares as you are to hear them talking about SWR and output power. A good part of this understanding has come from the excellent tutorials that Paul Harden NA5N has presented at various forums, including the internet QRP mailing list. This knowledge allows the QRPer to determine the best frequency to use and when to use it. It also helps you understand what is happening when the bands seem to get "weird", or when 40 meters is dominated by static crashes. It can give you a clue to when conditions will change for the better. Such understanding leads to more success with low power.

Another resource that helps you to know the current state of the ionosphere is the network of beacons that has been installed by the Northern California DX Foundation. Located at spots around the world, these beacon transmitters are carefully synchronized using GPS time receivers so they take turns transmitting on the same frequency. In three minutes, you can determine the state of propagation from your QTH to nearly any region of the world. One of the nicest features of these beacons is the fact that they transmit a sequence of signals at 100, 10, 1 and 0.1 watts, so you can get a very good idea of how well your QRP signal will be heard around the world. The beacons also operate on all bands from 14 MHz to 29 MHz, helpful for deter-

mining the best band to use.

Did you ever look at the scores from a contest and wonder why some guys made fewer QSOs than you did, but somehow earned a higher score? It's probably because they read the rules very carefully and figured out a strategy that took advantage of some of the features of the rules. For example, many contests combine the multipliers from all bands into one which is applied to the total QSOs. In this case, trying to get at least a few QSOs on each of as many bands as possible can quickly boost your score faster than running hundreds of stations on twenty and forty meters. Check out the rules for the QRP contests. You may find that the extra multiplier you get for one watt or less, more than makes up for a slightly lower QSO count at the lower power.

While we are on the topic of contests, did you ever notice that the semi-annual North American Sprint, famous for attracting the top echelon of contesting overachievers, has a unique set of rules that strongly benefit QRPers? The QSY rule makes it impossible for those kW behemoth stations to dominate a frequency. In fact, those S9+60 stations actually serve as beacons to draw others to your signal. Read the rules and check it out!

Equipment

A Pixie connected to a yagi antenna on a 60 foot tower with low loss 9913 coax will outperform a Yaesu FT-1000 connected to a dummy load every time. Yet both of these stations cost about the same amount of money. You may not want or be able to spend that much money to assemble a station, but where should you apply the dollars you have budgeted? The three most important secrets to QRP success are 1.) antenna system, 2.) antenna system, and 3.) antenna system. This includes your tuner, feedline, antenna, antenna mounting, and grounding. When you have only a few watts to start with, it is very important that you don't lose too many of them along the way to launching them into the ether. I recommend low-loss feedlines for home stations. I use 9913 and open wire line at K1MG, and other notable QRPers take similar approaches. It is helpful to understand the origin of losses in the antenna itself, and how they can mask a poor match to the feedline. I highly recommend that you model your antenna farm, home QTH and portable, already installed or still in the planning stages, with a computer modeling program such as W7EL's EZNEC. Try variations to see what effect they have. You will quickly garner a number of insights, such as why vertical antennas work wonders at the beach but may be disappointing at your mountain-top home, why some electric fence wires may make a better dummy load than antenna, and why center loading may work more efficiently than base loading.

It will also tell you that there is no substitute for altitude when it comes to HF antennas. You can also learn how to take advantage of geographic features, like the three hundred foot dropoff at your QRP-To-The-Field site.

On CW, use full QSK! There's really no excuse anymore. I want to be able to interrupt your monologue when I get bored, and vice versa.

Make sure you know how to use your radio. It sounds rather silly. After all, you've been using it for years. Do you know how to accurately zero-beat another station? Do you know how to switch it to receive on the other sideband for CW? Do you know when you would want to do that, and what happens to the frequency readout when you do? How can you optimize weak signal reception? You can often improve the signal to noise ratio by turning off the AGC, turning the AF gain all the way up, and adjusting the RF gain for best reception. What effect does your noise blanker have on that S9+60 signal that's only 3 kHz down the band from you? You may find that it adds tremendous intermodulation distortion that spreads that kw signal over many tens of kHz. How do the filter characteristics affect the copyability of a signal. Sometimes a station may be strong enough to easily hear, but hard to copy because of distortions introduced by the IF filter. You may find that a wider filter, or moving the signal to another part of the passband may improve copy dramatically. How well do you know your rig?

Attitude

Adopt a winning attitude. QRP means low power, not low scores or second-rate success. Many hams only answer a station calling CQ which is S7 or above, thinking that the weaker stations won't hear their pipsqueak signal. I suggest you go searching for the weak signals – push the envelope! Think Extreme Sports! QRP is about testing the limits of the sport of ham radio, but it's much safer than skateboarding while skydiving. Above all, go into it with confidence. You won't be successful all the time, but you will get through more often than you think. Set your own goals. Compete with yourself. Try to beat your score from last year in this year's contest. Try to work all fifty states with two-way QRP. Then try it with less than a total cumulative power of 5 watts. How about WAS using two-way QRPp? Push yourself; push your station, and above all, go at it with a winning attitude!

To round out that winning attitude, add a dose of patience, tolerance, and courtesy. These go a long way towards making your hobby fun and satisfying, for you and your fellow hams.

Training and Practice

As with any sport, training and practice are essential for success when operating QRP. Don't forget any aspect of your training,

including physical condition. Jump into those DX pileups; they are great practice for the serious sport of QRP-L foxhunting. For exercising your code proficiency, there are a number of programs available for the PC. One that comes highly recommended by top operators is RUFZ, available for download on the internet. But most importantly, shut off that PC once in a while and get on the air and operate! Getting in the game is the best way to improve your skills.

Summary

Nothing beats QRP for pure fun in ham radio, and nothing offers more of a challenge to your skills and training than operating QRP. Just do it!

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Harden, Paul NA5N; propagation reports to QRP-L, several ham conference presentations and journal articles

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Code training:

RUFZ, http://www.darc.de/referate/dx/fedtr.thm

Many other PC based programs

W1AW, Newington CT (schedule in any QST)

LEARNING ELECTRONIC CIRCUITS FROM THE "*DESERT RATT*" REGEN RECEIVER

Paul Harden, NA5N
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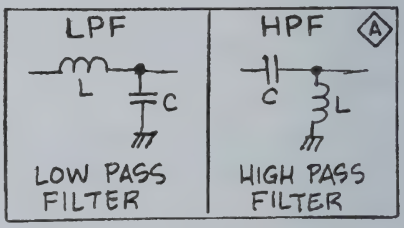
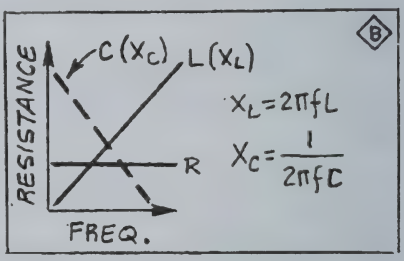
The "Desert Ratt" is a simple regenerative short wave receiver you can easily build.. In spite of it's simplicity, it works quite well. Additionally, it contains almost every basic circuit building block (except for a mixer). So let's look at these simple stages to better understand how they work. Hopefully, it will take some of the "magic" out of understanding these circuits and show some of the design steps involved.

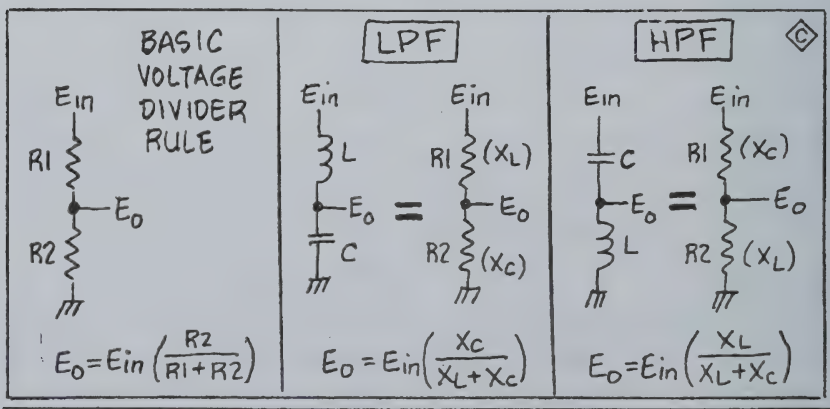
① THE UGLY TRUTH BEHIND FILTERS (They're Easy)

C1-L1-C2 forms a HIGH PASS filter (HPF), with a 3-dB cut-off around 3MHz, to reduce interference from AM broadcasting.



A LPF/HPF is just a voltage divider – where one (or both) of the "resistors" are replaced with frequency sensitive components – namely an inductor or a capacitor.





Let's analyze HPF C1-L1.
C1 = 200pF L1 = 15µH

The 6dB (half-power) point is where $X_C = X_L$. This also defines resonance ($X_C = X_L$). Thus, the same equation is used to find the 6dB point of an L-C filter

$$f_{6dB} = \frac{1}{2\pi\sqrt{LC}}$$

$$= \frac{1}{2\pi\sqrt{15\mu H \times 200pF}}$$

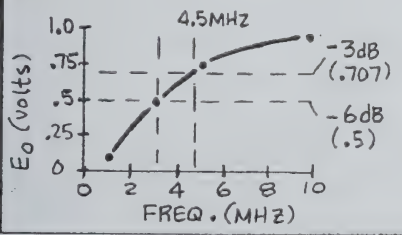
$$\doteq 2.9\ MHz$$

NOTE: 3dB = ½ for power
6dB = ½ for voltage

To make a filter response plot, calculate X_L and X_C at several frequencies above and below the f_{6dB} point, then E_O from FIG. C

MHz	1	3	5	10
X_L =	94Ω	283	471	940Ω
X_C =	796	265	159	80Ω
$X_L + X_C$ = (R1+R2)	890	548	630	1020
E_{in} =	Calculate using 1V			
E_O =	.1V	.5V	.75V	.9V
dB =	-20	-6	-2.5	-1 dB

RESULTING PLOT



HINT: It's real easy to do this with a spreadsheet. For a LPF - everything is the same except E_O is across the capacitor, not an inductor. See FIG. A.

Now - say you don't have a 15µH inductor. You only have a 4.7µH. Let's make the same HPF with the 4.7µH.

HPF DESIGN STEPS.
1. Choose the 3-dB "pole" to be the same 4.5MHz (see response plot)
2. 6dB point (where $X_L = X_C$) will be 4.5MHz -3dB (.707) or 4.5MHz × .707 = 3.2MHz
3. Calculate X_L for 3.2MHz
   $X_L = 2\pi \cdot 3.2\ MHz \cdot 4.7\mu H$
   $= 94\Omega$
4. Find capacitor where $X_C = 94\Omega$ at 3.2 MHz

$$C = \frac{1}{2\pi f X_C}$$

$$= \frac{1}{6.28 \times 3.2MHz \times 94}$$

$$= 529pF\ (use\ 560pF)$$

For LPF - same steps as HPF except to find L (step 4)

$$L = \frac{X_L}{2\pi f}$$

C2 ac couples the signal to the next stage and is customary to make C2 = C1. Although any value will work. However, smaller the value, the less loading to the LPF/HPF filter.

② Q1 – THE RF AMPLIFIER

The RF amplifier provides signal gain and helps to isolate the Regen stage from the antenna (so it's not a transmitter). With no tuned circuits, Q1 is a simple wide-band amplifier.

DESIGN STEPS

1. Choose operating point
   $V_C = \frac{1}{2} V_{CC} = 4.5V$ (9V BATT)
   $I_C = 2mA$
2. Calculate collector load
   $R_C = R2 = \frac{V_C}{I_C} = \frac{4.5V}{2mA} = 2.2K$
3. Calculate R1 to forward bias Q2 ($V_{be} \geq 0.7v$)
   $R2 = \frac{V_C - V_{be}}{HFE} = \frac{4.5v - 0.7v}{50}$
   $= 180K$ (use 200K)

Where HFE = the DC current gain of Q1, which is about 50-100 for the 2N2222, 2N3904, etc.

This scheme is not a very good amplifier (just simple). Let's see why not.

$$R_{in} \approx \frac{26\,HFE}{I_E(mA)}$$ ← varies with HFE; ← varies with HFE

and the voltage gain is

$$A_V = \frac{R_C}{R_E}$$ ← varies with HFE

Since emitter is grounded (no R_E), R_E = PN junction resistance, r_e, which varies also with HFE.

Thus, the gain of this amplifier depends on the HFE of the transistor, not the biasing or external components. HFE changes between one transistor and the next – so by finding a "hot" HFE transistor – you will get higher gain. This is OK for "one of a kind" projects, but not for production (or a kit!)

A good amplifier design includes "stiff" biasing, "fixes" the Rin and an emitter resistance – all to control the gain.

In the Desert Ratt, gain is controlled partially by L2, which shunts R2, to lower the gain, but make it higher at higher frequencies, where the sensitivity of the regen stage falls off.

$$R_C = \frac{R2 \times X_L}{R2 + X_L}$$

$R_E \approx 26\Omega$ @ 1mA

At 6MHz, $X_L = 565$

$R_C = 2.2K \| 565 = 450\Omega$

$A_V = 450/26 = 17$ (25dB)

At 12MHz, $X_L = 1130$

$R_C = 2.2K \| 1130 = 746$

$A_V = 746/26 = 29$ (29dB)

(3) Q2 - THE REGEN STAGE

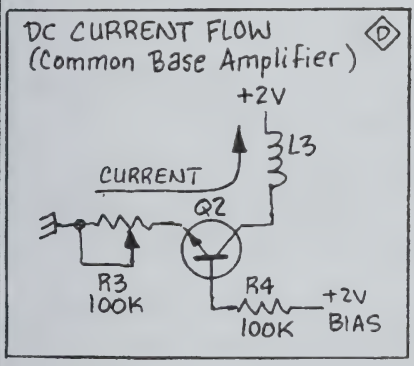
The Desert Ratt uses a regen stage designed by Charles Kitchin, N1TEV. It is a clever circuit producing a "soft" regen far more suitable for AM detection than most regen circuits.

Q2 is actually a common-base amplifier, which has these characteristics:

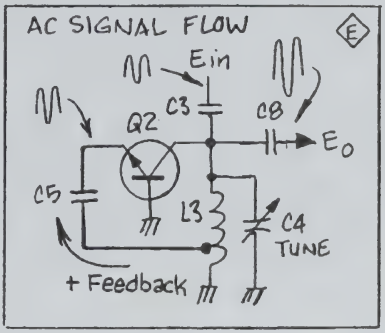
- No current gain
- High voltage gain *
- Prone to oscillation at high gains. *

* Items exploited for a regenerative amplifier

The DC CURRENT flow thru Q2 is shown in FIG. D.



The base is biased ~2V to cause conduction. The amount of current flowing through the collector and load L3 is set by R3, the emitter resistor. The lower the value of R3, the HIGHER the gain.



The input to a CB amplifier is to the emitter, not the base like the CE amplifier. The input from the Q1 RF amplifier is applied to the L3-C4 resonant circuit via C3. The signal is tapped off L3 and becomes the Q2 input via C5. Note the feedback signal to Q2 emitter is IN-PHASE to the input signal forming POSITIVE feedback. The feedback signal to the emitter is amplified by Q2. The amount of gain is determined by R3.

The amplified output from Q2 is added to the input signal at L3, tapped off and applied to the emitter, amplifying the signal further. This additive (regenerative) amplification continues until the Q2 circuit goes into oscillation. By reducing the gain with R3, a point of

extremely high gains, just before oscillation, are acheived. Voltage gains of 100,000 – 200,000 are typical, even with only the 2V Vcc. Unlike the other amplifier circuits, there are no equations to calculate the voltage gain of a regen amplifier stage.

For the AC signals, the base is grounded through C6 and L3 is grounded by C7.

However, the tuning range of the receiver is calculated from the resonant circuit L3-C4:

$$f_r = \frac{1}{2\pi\sqrt{L3C4}}$$

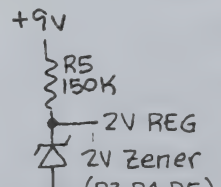
C4 min = highest freq.
C4 max = lowest freq.

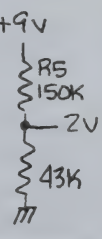
(4) THE L3-C4 "TANK" CIRCUIT

Part of the fun of building the Desert Ratt is winding different coils for different frequency ranges. The feedback tap should be about 1/3rd of the total windings for good feedback. Adding a capacitor across C4 (parallel) will lower the frequency, while adding capacitance in series with C4 will narrow the tuning RANGE.

(5) D3-D5, A POOR MAN'S REGULATOR

What makes the N1TV regen stage to have such smooth regeneration is operating the stage from only 2V. D3, D4 and D5 act as a 2V zener regulator. Each diode drops ~0.7V, times 3 for about 2V.





It will stay at 2V, even when the battery voltage drops well below 9v.

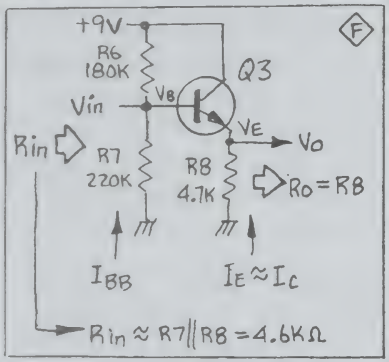
R5 must drop the remaining 7V. The current thru the regulator is

$$I = \frac{E}{R} = \frac{7v}{150K} = 47\mu A$$

Remember the voltage divider rule in FIG. C? This can be used also to make the 2V, although the point of regen changes as the battery discharges.

⑥ Q3 - EMITTER FOLLOWER (E.F.)

At proper regen, Q2 has a high Q and output impedance. When the detector diode is conducting, it has a low impedance - which loads down the Q2 stage, lowering the Q and the gain. I added the emitter follower to isolate the detector from the Q2 regen stage.



An emitter follower has NO GAIN. So what good is it? Well, it has a high input resistance and a low output resistance - and can be used as an "active" transformer.

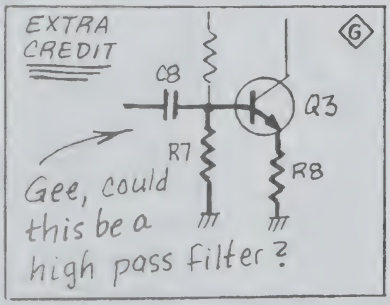
$$R_{in} = R7 \| R8 = \frac{220K \times 4.7K}{220K + 4.7K} = 4.6K\Omega$$

Thus, input resistance is dictated by R_E (R8). So make R8 relatively high.

Biasing is not critical. R6 and R7 are often made the same values to save the DESIGN STEPS #5-9. For example, R6 and R7 could both be 100K to 200KΩ and still produce about the same base current.

DESIGN STEPS

1. Choose $V_E = V_O = \frac{1}{2} V_{CC} = 4.5V$
2. Choose $I_C = 1mA$
3. $R_E = R8 = \frac{V_E}{I_C} = \frac{4.5V}{1mA} = 4.5K$
4. $V_B = V_{be} + V_E = 0.7 + 4.5V = 5.2V$
5. $I_B = \frac{I_C}{HFE} = \frac{1mA}{100} = 10\mu A$
6. $I_{BB} \approx 2$ to 10 times I_B at 2.5 times $= 25\mu A$
7. $R_{bias} = R6 + R7 = \frac{9V}{25\mu A} = 360K$
8. Need $V_B = 5.2V$ across R7
   $R7 = \frac{V_B}{I_{BB}} = \frac{5.2V}{25\mu A} = 208K$ (220K)
9. R6 drops remainder
   $R6 = \frac{9V - 5.2V}{25\mu A} = 152K$ (180K)



YES! C8 with Rin (R7 parallel to R8) forms an unintentional High Pass Filter.

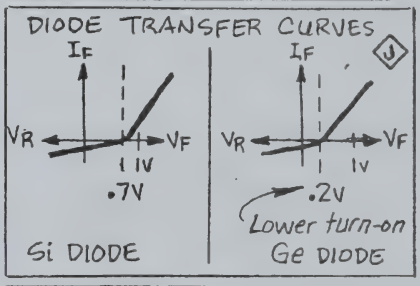
$$f_{3dB} = \frac{1}{2\pi RC} = \frac{1}{6.28 \times .005 \times 4.6K\Omega} \cong 7KHz$$

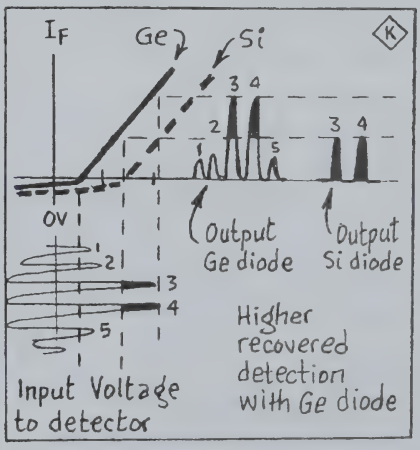
(7) D1, D2 – THE A.M. DETECTOR
(Not to be confused with PM detector!)

The original Desert Ratt used a single IN34 germanium diode detector (half-wave) while this version employs a 2-diode full-wave detector for higher audio recovery.

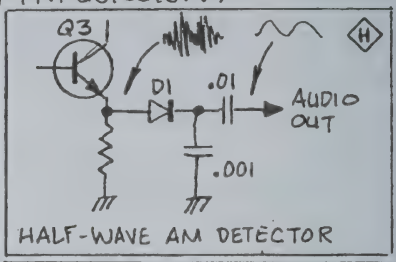
Germanium diodes should be used (IN34, IN270, etc.) due to their lower forward voltage drop over silicon diodes.

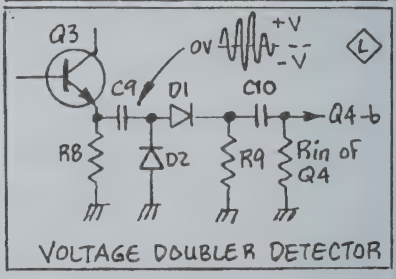
WHY GERMANIUM DIODES?



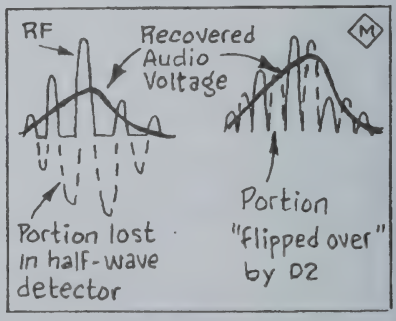


The lower forward volt. drop (V_F) of Ge diodes allows more of the input voltage to be rectified and recovered.





In the full-wave/volt. doubler circuit, D2 conducts during the negative (-V) portion of the signal. This makes more charging current thru C9 and C10 for higher average detected audio across load resistor R9.



Each cycle of the RF signal is converted to positive voltage "pulses," which charges C10 to the average voltage by the time constant of C10, R9 and Q4 Rin. This is the audio.

(8) Q4 AUDIO PRE-AMPLIFIER

Q4 is a very common audio amplifier circuit. Base bias of ~2v comes from voltage divider R10-R11. Calculated gain is:

$$A_V = \frac{R_C}{R_E} = \frac{R13}{R12} = \frac{1.6K}{220} = 7\ (17dB)$$

With a moderately strong shortwave station tuned in, there will be 10-20mV of audio from the D1-D2 AM detector. This will be amplified to around 100mVpp, which is sufficient audio drive to the LM386 audio output amplifier to drive an 8-ohm speaker.

You can increase the gain of the Desert Ratt (if needed) by increasing R13 to 2.0K or 2.2K. Likewise, you can reduce audio gain by making R13 smaller.

Better low frequency response can be obtained by bypassing R12 with larger cap (try C11 = 4.7μF) or making C12 >1μF. It's that

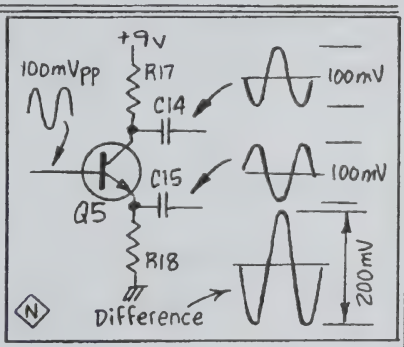
High pass filter thing again. A larger C12 will pass lower freq.

(9) Q5 PHASE-SPLITTER

There's lot of RF floating around due to the Q2 regen stage – which gets into the LM386 and causes distorted audio and other problems. I added the phase splitter to drive the LM386 with DIFFERENTIAL SIGNALS, so the common-mode RF stuff would cancel out. It is an optional stage, and offers no gain since

$$A_V = \frac{R_C}{R_E} = \frac{R17}{R18} = \frac{4.3K}{4.3K} = 1$$

But by converting the single-ended audio to differential, you pick up 6dB of gain, as shown in FIG. N.



Each output (C14, C15) is 100mV, as is the input for no gain. But when added together by the LM386, the difference becomes 200mV for a volt. gain of 2 = 6dB.

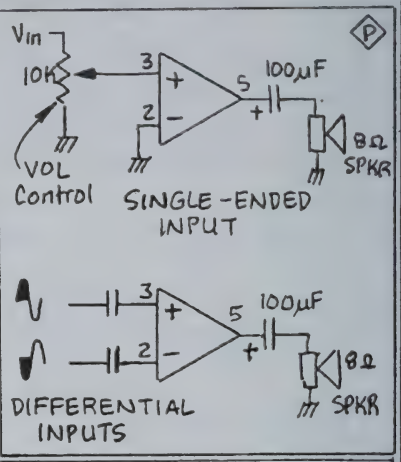
Values for R17 and R18 is not critical, provided they are equal in the range of 1-5KΩ.

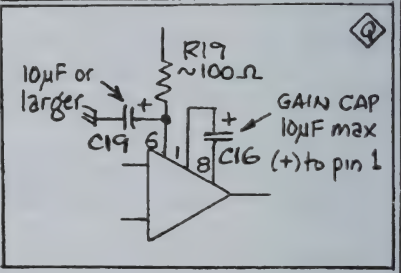
(10) U1 - THE LM386 AUDIO AMPLIFIER

The LM386 is an inexpensive audio amplifier I.C. widely available - even Radio Shack. Normally it is operated in the single-ended mode as shown in FIG. P.

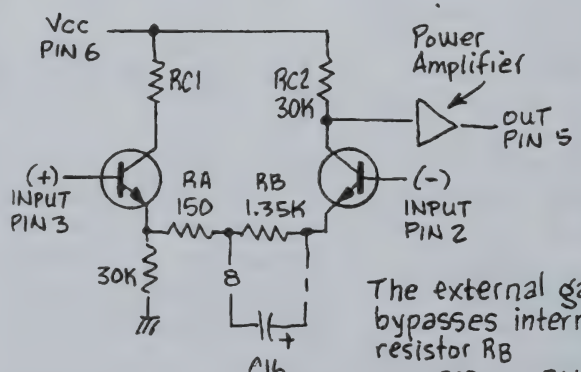
The LM386 has programmable gain. With no external capacitor, it has a voltage gain of 20, or 26dB. By adding an external gain cap between pins 1 and 8, (10μF typical) the gain is increased to 200, or 46dB. See FIG. Q.

Good power supply bypassing is important by making a low-pass filter (R19-C19). C19 can be much larger than 10μF - to 220μF, to keep the DC volt. on pin 6 constant.





INSIDE THE LM386



The external gain cap C16 bypasses internal gain resistor RB

$$A_V = \frac{RC2}{RA+RB} = \frac{30K}{1.5K} = 20$$

bypass R_B = $\frac{30K}{150}$ = 200

GL and 72,
Paul NA5N

The BLT, A Balanced Line Tuner

by Charlie Lofgren, W6JJZ and Doug Hendricks, KI6DS

This tuner was designed by Charlie Lofgren, W6JJZ, who is renowned in the QRP World as a tuner expert. Charlie has built all of the tuners used by the Zuni Loop QRP Expeditionary Force for years, and they all swear by them.

TheBLT is a balanced line tuner only, and will not work with coax feedlines unless modified as shown in the mods and improvement section.. But it works great with open wire feeder, ladder line, zip cord, and ribbon cable. As long as you are using balanced line as a feedline, this tuner will work.

Charlie designed this tuner to work specifically with the polyvaricon variable capacitors available from Mouser. I asked him to design it at first because I wanted a simple tuner for a presentation that I was doing at the Ft. Smith QRP Group Forum, ArkieCon 2000. It turned out so well that everyone who saw it wanted one. Thus the NorCal W6JJZ BLT Kit was born. I would like to thank Charlie for his efforts on behalf of NorCal. This one is going to be a classic.

The design is for a classic Z match, using inductive coupling with L1, L2 and L3 wound on a single T106-2 toroid. L2 or L3 is switched in and out of the circuit by Switch 2, located on the back panel of the tuner. .The "high" and "low" positions on the switch for the output links may need clarification. The positions are for "high" and "low" in terms of impedance, not frequency. For a given band and antenna, try the high Z link first, and use the low Z link only if a match can't be found with the high link. (Often either link will allow a match. In these instances, the high Z link produces better efficiency as a result of loading the tank circuit more heavily.)

The circuit also includes the famous N7VE LED SWR indicator circuit. Dan Tayloe invented this several years ago, and it has proven a great addition to the qrp fraternity. This allows us to have an indication of lowest SWR on the tuner (indicated by dimming or LED going out at minimum SWR).

The circuit also is an absorptive bridge, which means that your transmitter sees a 50 ohm load as you are tuning up, which will help to save your finals. This tuner is rated at 5 Watts. I doubt if the polyvaricon caps will take the 100 Watts of your big rig!!

The first step in building the rig is to build the custom case. The case is made out of .060 pcboard stock, and has been precut to size for you. All that you have to do is drill the holes for the front and rear panels, and then solder the kit together.

If you have tried to build a case out of pc board and had trouble keeping the sides square, you are not alone. But George Heron, of the NJ QRP Club has figured out the secret of building these cases and shares his secrets here.

The parts for the case have been mass produced. You need to check them to make sure that you will have a good fit. Start with the top and the bottom. The top should be 1/8" wider than the bottom. Check the two pieces to make sure that they are. If they are not the correct size, use a straight edge to mark a file line, and file the edge to the correct size. Be sure to do this check as it will affect how your case fits. Next, check the front and back panels, make sure that

they are the same width as the bottom, if not mark and file as before.

Locate the front and rear panels. You will use these as "guides" to help keep the sides of the top square. Use one of the side panels (B) and place it along side the top. It will go on the top of the panel as shown in Fig. 1. Next, take the front panel, and tack it in one spot on the underside of the top, using the side panel to make sure that the the side panel fits flush with the edge of the top. See Fig. 1.

Use the guide to keep it square, and tack it on one end of the side panel. Now, go to the other end of the side panel and tack that end. Make sure that the side is flush with the top. Now, tack the bottom of the "guide" panel to the top edge of the side as shown in Fig. 1. This will keep the side square to the top as you solder. Don't use a lot of solder here, because you are going to have to unsolder this. Also, be sure that you solder on the side that will not show of the "guide" piece.

Once you have the guide ready to go, just fill in the seam with solder along the edge of the top and the side. I tilt mine at a 45 degree angle, and it works very well.

When you finish with the first side, do the other side just like you did the first. When you finish, unsolder the guide using solder wick, and you have the top finished, all nice and square. Now for the good news. You have just finished the hard part of the case. The bottom section is a piece of cake.

First, use the drilling templates to mark the holes as indicated and drill the front and back panels to the size indicated. Make sure that you are accurate on the capacitor holes, as you do not want to have the center shaft of the capacitor touching the case. An easy way to mark and drill the holes is to cut out the front and back hole locating drawings and tape them over the front and rear panels. Then, using a 1/16" bit in a drill press, it is a simple matter of drilling through the paper at the X marks the spot locations of the holes. Then you can enlarge the holes to the proper sizes as indicated.

Now that you have the holes drilled we are ready to start the bottom case assembly. Take the bottom piece and one of the side rails. Line up the side rail with the ends flush and the sides flush. Tack solder it on one end. Get it as straight as you can, but don't worry about it, we will adjust it later. What we are concerned about is that the ends are flush. Now, place the front panel against the ends of the bottom and the side panel. Make sure that it is oriented correctly, lined up, and solder it on one end. Check your work. If everything is lined up, unsolder the side rail and make it fit straight, flush with the edge of the front panel. Now, solder the bottom of the side rail and the junction of the top side of the side rail and the front panel. Do the other side rail as you did the first. This will hold the front panel square, and now you may tilt it up to solder the seam as you did on the top.

When you finish the front panel, do the same with the back, making sure that you orient the panel correctly. The case is really quite easy to build and the neat thing about it is that you use the parts to self align it. Many thanks to George Heron, N2APB for his invaluable assistance with these instructions. In other words, George, thanks for the trade secret, grin.

We are ready to start building the tuner. The first step is to prepare 6

wires that are 4" long. Solder 4 wires to Switch 1 as shown in the wiring diagram on the schematic page along with the jumper. Mount Switch 1 in the front panel. Next, solder two wires to the middle connections of Switch 2. Mount Switch 2 in the back panel.

We are ready to wind the two toroids now. Start with the larger one, the T106-2. Cut off 30" of the heavy red enameled wire. Bend it in half, and clean off the insulation for 1/2" on either side of the center of the wire. Then, twist the wires together 3 times forming a tiny loop that will be the center tap of L1. Take the toroid, put the wire through the center of the toroid and hold the twisted loop against the edge. Wind the wire 8 times around the toroid, counting 1 turn each time the wire goes through the center of the toroid. Now, wind the other end of the wire 8 more times going in the opposite direction. When you finish, spread the turns evenly around the toroid, and bring the ends of the wire up to the side opposite the twisted loop, trim the wires about 3" long.

The coils for L2 and L3 are wound interspersed and in the same direction as L1. The wire for L2 is 24" long, and the wire for L3 is 12". When you finish winding L2, the toroid will have two wires sticking up on the outside of the toroid, and two coming up through the middle. When you finish with L3, you will have 3 wires on the outside, and 3 on the inside.. Place the toroid in the case approximately where it will be and trim the wires to the lengths needed to attach L2 and L3 to Switch 1 and to attach L1 to C3. Clean off the insulation by burning it back for about 1/2" and then carefully scraping off the residue with a knife. Now you are ready to mount the big toroid. Place it where it goes in the case, and solder the tap of L2 to the bottom of the case. Then solder L2 and L3 wires to Switch 2. We will solder the connections to C3 later.

Now lets wind the smaller toroid. You have two smaller diameter pieces of wire, one red and one green. Start with the red wire and wind 25 turns on the toroid. Count the turns on the inside of the toroid with each time the wire passes through the center of the toroid as one turn. Trim the wire to 1 inch leads, remove theinsulation and tin the leads. Now, take the piece of green wire and wind 5 turns. Start the winding in the middle of the red wire and the toroid should look like the drawing below. Trim the ends of the green wire to 1", remove the insulation and tin the leads. Set the toroid aside for now.

Prepare the six 100 ohm 2 watt resistors by twisting the leads together to make 3 pairs of resistors. This will result in 3 - 50 ohm resistors.

Now we are ready to build the SWR absorptive bridge and LED indicator circuit.

Use the layout drawing as a guide and build the circuit Manhattan style. You will find several round pads provided in the kit. Use these as "tie points" as shown. They are glued down to the base of the case using super glue. One small drop per pad is plenty. Place the drop where you want the pad, then with tweezers or needle nose pliers place the pad on the glue. Press down and hold for 30 seconds. Tin the pad. When you have the pads in place, build the circuit. The ground symbol means that you solder the end of the component to the base of the case, which is ground. Make sure that you orient the diodes correctly. The LED has the short lead grounded to the case

front which holds it in place, or you may use a drop of super glue here, just be careful to not get it on the lens. The other lead of the LED connects to R4, the 1K resistor.

Now we will prepare C2 and C3. Put a jumper between the outside leads of each capacitor as shown. Then, make sure that the trimmer adjustment caps on the back are set at lowest capacitance, which means fully unmeshed. Now mount the two caps to the front panel. Make sure that the center conductor does not touch the case, or your tuner will not work right. Tighten the small screws snug, but be careful to not strip the threads. Run a jumper wire from the two tied together connectors on C2 to the two tied together connectors on C3. Connect the middle connector of C2 to SW1 as shown.

The caps do not have shafts for knobs, but we can fix that easily. In your kit of parts you will find two nylon spacers. Attach them to the center hole of the cap with the 2.5 x 16mm screws provided. You will want to put a drop of super glue between the spacer and the cap to keep it from spinning, or you could use a tiny lock washer here (not provided). Just be careful to not get any glue in the cap!! Now you have a shaft to attach the knobs to!! Thanks to Dave Gauding, NF0R who showed me that trick.

Connect the L1 wires as shown on the wiring diagram.

Finish wiring the connections for SW1 and SW2. Check the diagrams to make sure that you have connected all the wires. That is all there is to it. Your tuner is now finished!!

To operate the tuner, connect a balanced feedline to J2 and J3. Run coax from the BNC to your rig. Place SW1 in the Tune Position. Place SW2 in the High impedance position. Press the key or put your rig in "tune" mode, and use the two tuning knobs on the front panel to get the LED to go out, or at least dim significantly. If you can't get a match on high impedance, change to low impedance with SW2. My tuner tunes a NorCal doublet made from ribbon cable and 20 feet up in the air on all bands from 10 - 40 meters. You mileage may vary.

Mods and Improvements:

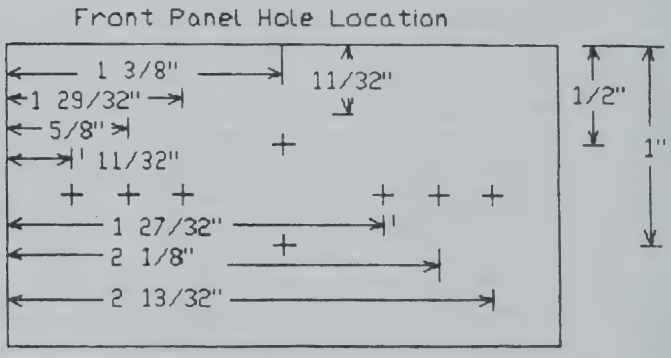
If you wish to use the tuner with unbalanced feedlines, i.e. coax or long wires, then you need to do the following mod. Mount a spdt toggle switch on the back panel and another chassis mount BNC. You will use the toggle switch to ground one side of the balance input conncectors. To operate as a balanced tuner, switch to the unground position. To operate as an unbalanced tuner place the switch in the ground position. Simple mod. But if you are going to do it, I suggest that you do it before you build the tuner, as it is easier to do at that time. Radio Shack has a nice miniature SPDT switch and they also carry BNC chassis mount connectors.

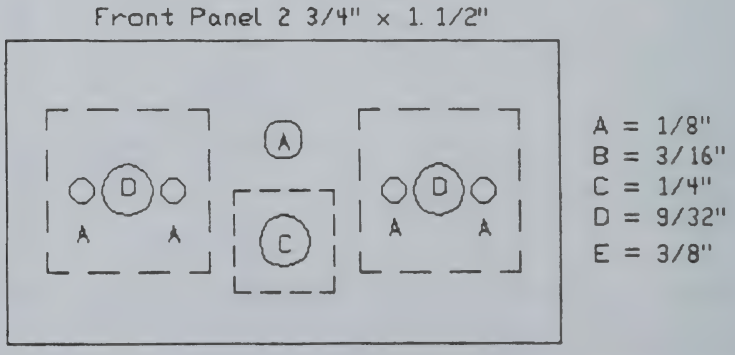
Good luck, enjoy your tuner, and have fun on the air. Many thanks to Charlie Lofgren, W6JJZ for his invaluable assistance on this project. 72, Doug, KI6DS

BLT Tuner Kits are available from NorCal. The cost is $25 plus $4 S&H for US & Canada, $6 Europe & Far East. The kit is complete with all parts, pcboard case, and clear lexan cover. To order send a money order or check in US Dollars to: Doug Hendricks, 862 Frank Ave., Dos Palos, CA, 93620. Please make check to Doug Hendricks and NOT to NorCal. Please enclose a self addressed mailing label.

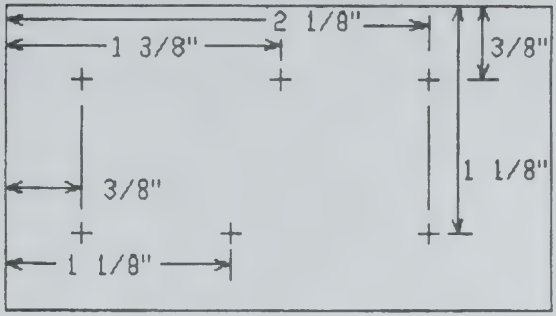
NorCal W6JJZ "BLT" Tuner
J1
Input
SW1
DPDT
Operate
Tune
R1
50Ω
R2
50Ω
R3
50Ω
5T
25T
T1
C1
.1μF
R4
1KΩ
D1
1N34A
D2
RS276-309
C2
10-220pF
C3
10-220pF
L1
L2
L3
Hi
Low
HI
Low
SW2
DPDT
J2
J3
Output

C1, C2 = 140/80 "Poly" caps with sections in parallel
Be Sure to set trimmers to 0.
L1 = 16T #22 Enameled Wire on T106-2 Toroid
Tapped at 8 Turns to ground
L2 = 12T#24 Enameled Wire centered around
ground tap on L1, and interwoven with turns of L1
L3 = 6T #24 Enameled Wire centered around ground tap
on L1, and interwoven with turns of L1 & L2.
T1 = 5T Primary, 25T Secondary on FT37-61
R1, R2, R3 = 2 - 100 ohm resistors in parallel.



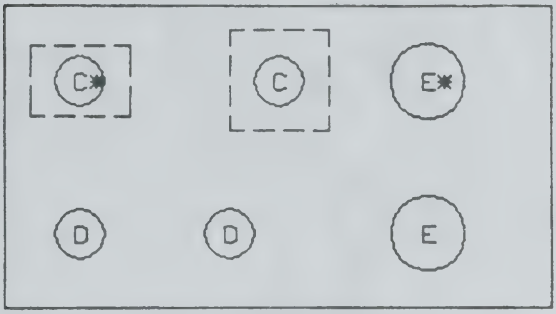


Back Panel Hole Location

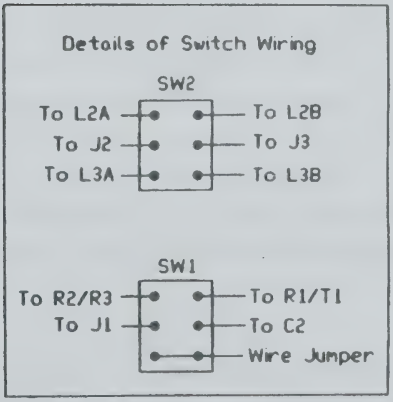


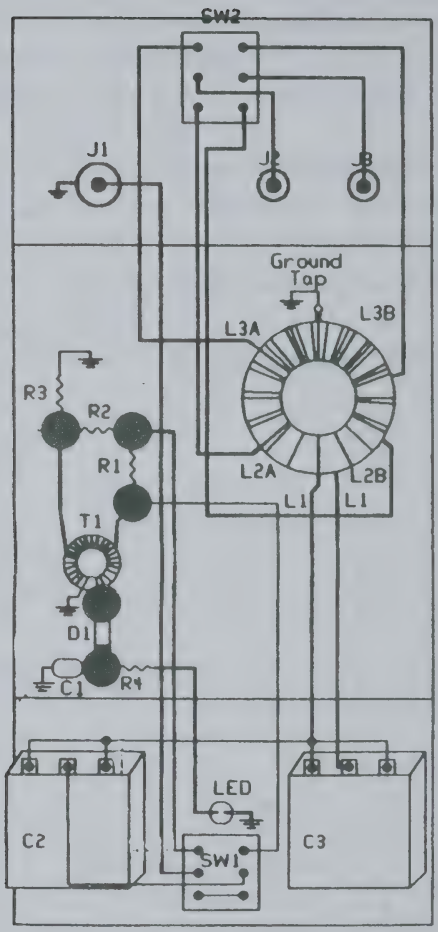
Back Panel 2 3/4" x 1 1/2"

A = 1/8"
B = 3/16"
C = 1/4"
D = 9/32"
E = 3/8"



Note: C* and E* are optional





Wiring diagram and parts placement for the BLT tuner. Note that the front and rear panels are shown iin a "folded" down position for illustration only.

Pacificon 2000

Friday,Saturday and Sunday

Oct. 20, 21, 22

Sheraton Hotel
Concord, California

QRP Forum Speakers

Saturday

Tony Fishpool, G4WIF, Dartford, England
Graham Firth, G3MFJ, Leeds, England
George Heron, N2APB, Forest Hill, MD.
Mike Gipe, K1MG, Saratoga, CA.
Dave Gauding, NF0R, St. Louis, MO.
Dan Tayloe, N7VE, Phoenix, AZ.
Vern Wright, W6MMA, Placerville, CA

QRPp Columnists:

Richard Fisher
Paul Harden

Will be on hand to meet and visit with you all week-end. Give your suggestions to them for things you would like to see in their columns.

4 Building Contests Saturday Night
SMK-1 Operating Event Friday Night
No Host Dinner at Fuddruckers Friday Night
Red Hot Radio NC20, Red Hot NC20 and Red Hot 40
Group Picture Saturday Afternoon (all who bring radios for the photo will receive a free t-shirt from Red Hot Radio
QRP Open House Friday and Saturday Night
NO Additional charge for any QRP Functions
Sponsored by NorCal QRP Club

We have another exciting program planned for you this year. Friday night, we will have a no host dinner starting at 6:30 at Fuddruckers, a hamburger emporium near the hotel. We will meet in the lobby at 6:00 to arrange rides.

Then we will return to the hotel where we will have a QRP Open House Hospitality room starting at 7:30 PM. The feature event on Friday night will be an SMK-1 QSO party. This fun event will start at 8 PM and run for one hour. At the end of the hour, we will exchange qsl cards for the contacts that you have made. Since this is a qrp event, we want qrp qsl cards. So guys, get one of the qsl maker programs, and make some business card sized qsl cards!! The required info will be Stations Call, RST, Name, and first year licensed, date, time & frequency.

You must run an SMK-1 rig to participate, and you may use any antenna that you can fit into the room. (Note, you may not attach the antenna to the walls with any type of tape, nails, staples, old gum, hot glue gun, etc.). The idea will be to work as many stations as you can with your SMK-1. You may modify your SMK, you may bring outboard filters, but your rig must be an SMK. After the QSO party, the operator with the most qso's will be awarded a prize.

The rest of the evening will be spent visiting.

After the final qrp session on Saturday, Dave Fifield, of Red Hot Radio is hosting a Kodak moment for all NorCal 20, Red Hot Radio NC20, and Red Hot 40 owners. If you bring your radio for the group picture, Dave will present you with a free Red Hot Radio T-Shirt as a special token of his appreciation for your support of Red Hot Radio and QRP.

Saturday night will feature the famous NorCal Building Contest, and this year we will feature the SMK-1 "beauty contest". We will judge your entry for quality of construction and packaging. There will be two divisions: NJQRP Club SMK-1 Case Kit and Original Case Also, JayBob Bromley and the Ft. Smith QRP group will sponsor the Ft. Smith QRP Group P-TiCK division. Bring your P-TiCK, and we will decide who built the best version of this fabulous $10 kit.

Finally, we will have the Manhattan construction division. This will be for any project built using Manhattan Style construction and not entered into a contest previously.

Pacificon will be fun this year. As always, no additional charges for any of the QRP activities, other than the admission to the hamfest. This is NorCal's way of reinvesting in QRP. We want to encourage QRP and to have fun.

Hope to see you in Pacificon. I'll be the guy with the thick glasses, no hair, and a big grin on my face having fun.

72,

Doug

QRP Operating News

By Richard Fisher, KI6SN
1940 Wetherly Way
Riverside, CA 92506

KI6SN@yahoo.com

New and Noteworthy

Bob Reisenweber, W3BBO, writes from Erie, PA that he was very glad to see the new QRPp Operating News column. After receiving his Winter edition, he "wanted to drop a note and wish (the new column) well.

"I was very fortunate in my introduction to QRP. I was working in New Jersey and living in a basement apartment.

"The XYL and family were a seven hour drive away, so I only made it home every four to six weeks, with longer periods between trips during the winter.

"So what can a guy do?

"You work all day, come back to the apartment in the evening and turn on the 'boob tube.'

"That gets old quick, so I thought building a QRP rig might be fun, plus it would occupy some of my evenings.

"Thank God for computers and the Internet!

"Here I found all sorts of web sites that pertained to QRP, like operating, kit building and clubs!

"Off went my order for (an Oak Hills Research) OHR-100A to cover 20 meters.

"Then the biggest step of all, I joined the New Jersey QRP Club.

"Wow! What a great bunch of people.

"All were eager to share ideas, stories and help.

"Now that I'm back home and safely retired, I miss most those gatherings we had. However, I stay in touch thanks to the NJ-QRP web site and trips to Atlanticon.

"Milliwatting can be a blast! The NJ-QRP club sent a SNAP kit to each person attending Atlanticon 2000.

"This kit was a simple crystal controlled, single 2N2222A transistor oscillator for 80 meters.

"The purpose was to build the rig using 'Manhattan-style' construction and be judged in the building contest at Atlanticon.

"Needless to say, we just didn't build the unit and wait for Atlanticon - several of us decided to put it on the air!

"My best contact was with a VA3 station just outside of Toronto.

"My SNAP was running slightly under 20 milliwatts and I obtained the QRP ARCI 1,000 Mile per Watt award for this contact.

"The award gives the mileage as 5,650 miles per watt.

"Certainly not a world record, but it still amazes me that milliwatting works at all, and my hat is off to guys like (Jim Hale) KJ5TF, N4ROA and the many other milliwatters who experience this thrill daily!

"Regarding QRP contesting, I'm not sure which types of contesting I really like best - QRP contests or the major tests.

"On the QRP side, there is the monthly Adventure Radio Society's Spartan Sprint, the QRP ARCI QSO Parties, plus really fun events like QRP To The Field (QRPTTF) and the Zombie Shuffle.

"The major contests for me include the Pennsylvania QSO Party, ARRL November Sweepstakes,

ARRL DX and the CQ WPX tests. All are fun!

"The QRP tests are more laid back and most stations will QRS and even ragchew, however the major tests are more demanding and everyone is going for 'rate' and 'score!'

"In either case, operating in these events will improve your CW skills and operating technique.

"So turn the rig on and jump in. You may find you like contesting!

"As for QRP ragchewing, I guess I'm a DX'er at heart.

"When that rare DXpedition comes on the air, I'm in there trying my best to make the QSO.

"Unfortunately, now days the operating practices have seemed to slip considerably.

"The DX station frequency gets QRM'd.

"Frequency police then get all worked up, and chaos ensues. That's when I take a deep breath, switch bands and look for a nice ragchew! I've had some great QSOs on 40, 80 and 160 meters.

"Amazing what a nice QSO can do to relieve the frustrations caused by chasing DX.

"A couple of real 'characters' that I'd like to read about include that guy Nils, W8IJN, and the displaced cajun, Joel, KE1LA! Plus many more like that don't immediately come to mind. I'm sure you have a warehouse full!

"On the swap meet scene, this past Fall I attended the Buffalo hamfest and ran into Howard, K2UD.

"Howard was wearing his QRP namebadge and carrying a knapsack.

"After I introduced myself, Howard opened his bag and brought out his homebuilt 2N2/40 rig. Right there in the middle of an aisle, we stooped down and Howard removed the transceiver cover and showed me his Manhattan constructed unit.

"What beautiful construction, a work of art! A week or two later, I worked Howard on 40 CW and the little rig sounded as sweet as it looked!

"Often I wonder what all the hip-toting HT people walking by thought."

QRP adventures on the AT

Steven Weber, KD1JV, writes from Gorham, NH: "Boy, I'm a little tired and sore.

"When I got up this morning, the weather looked a little iffy, but by the time I got to the trail head at noon, the clouds were breaking up and some blue sky could be seen, so went ahead with the hike.

"It's been some time since I've last visted the Gentian Pond Shelter along the Appalachian Trail as it passes through New Hampshire.

"I had remembered it wasn't a difficult hike, but had forgotten it was fairly long, about 5-6 miles, with the last 3/4 mile a pretty stiff climb, which is generally the case around here.

"Over all, the climb is about 3,000 ft. Took 2 1/2 hrs to get to the shelter, steady walking, no significant breaks. If you stop, all the bugs catch up with you.

"Shortly after arriving and setting up, an Appalachian Trail through hiker passed by on his way to Maine, so had to chat with him a while and explain the little radio and all.

"Finally made my first contact at 19:11 UTC with W1PID, then N1MGA, N1EI, a long chat with N3CU, then W3PNL and finally W1II.

"So, only six contacts, all on 40 meters. Twenty meters seemed dead. Amazing how quiet the radio is that far into the woods.

"By 20:00 UTC, 4 PM EDT, the clouds were getting thick, dark and lower, so decided it was best to pack up and run down the trial.

"Got back to the car just minutes before it started to rain. Whew. Fed quite a few 'sketers on the way down and a number of black flies on the way up.

"All in all, a good day's work out, though not too productive contact wise. Will have to do it again, maybe make it an overnight next time.

"Just wish it would stop raining every darn day.

In the hunt with the SMK-1

Bob Cromwell, KC9RG, writes that he's "been on the road with work, and have only recently gotten my SMK-1 on the air.

"I made the ~850mW mod, getting the 12V supply for the final with a 1 mH choke - hey, it was handy - connected to a through hole near a transistor on the pot side of the transformer. I don't have the board with me here in the lab to quote the exact location.

"With an antenna consisting of a quarter-wave of wire thrown off my second floor apartment balcony and draped head-high through a couple of trees, I managed to work WA3BKD/MM on a houseboat on the Ohio River north of Wheeling, WV.

"As I'm in West Lafayette, IN, I'm pretty happy with that!

"The next step is to test my new antenna, which is a discrete connection to the building's rain gutter.

"First HF QSO from home in, wow, probably 10 years! Have been on HF at the Purdue Radio Club (W9YB) but not from a series of apartments.

"The SMK-1 provides fun and a sense of accomplishment — what more do I need? I know, I know, the next SM kit!"

Building the NW8020

David Bixler W0CH / VK2IQX, writes from Seneca, MO that he "just wanted to share with the group about my latest project, the building of a Emtech NW8020 for 20 meters.

"This particular kit has been unbuilt since 1996, and was probably kitted by the late Roy Gregson, W6EMT.

"I started the board stuffing on a Tuesday evening and by Thursday I had a working receiver.

"The NW80XX case arrived from Emtech also on Thursday.

"I finished the transmitter parts placement on Saturday and by Sunday I was putting the board into the bottom half of the case.

"Sunday night, I fired it up on a real antenna for the first time and found the band active with signals.

"Tried calling N4ROA, who was CQ'ing for a QRP contest, but had no luck.

"I then went down the band and heard a strong F9 (France) calling CQ.

"I gave him a call, and he came right back. Got a 559 report from Tourlouse, France for the first QSO. Not too bad for 4 watts to a vertical wire.

"Second QSO honors went to Dave Gauding, NF0R, up in St. Louis who was working the contest with a mighty 250 milliwatts.

"I got a few details to finish on the rig (like putting the knobs on) before putting the cover on. But it looks like this is going to be a nice little rig."

Flight with a Bumblebee

Bruce Grubbs, N7CEE, writes from Flagstaff, AZ, that "a non-ham friend proposed a last minute backpack trip in California's Sierra Nevada, so I ended up operating my Wilderness Radio Sierra from its namesake range for the first time.

"The Adventure Radio Society's 'Flight of the Bumblebees' fell on the

fourth day of the six day trip, and the operating site was spectacular - near Paris Lake in the Mount Humphreys region, at 11,200 feet (DM07pg).

"I used a ZM-2 and 66 feet of wire, end fed, and a 33 foot counterpoise. The antenna was up about 20 feet on the timberline whitebark pines.

"I worked 20 stations - far below last year's total - as conditions on 20 and 15 were rough.

"Signals were right in the noise. Forty meters was strong but everyone worked was 'local,' of course.

"My non-ham friend was very supportive of the whole operation - in fact Doug made me take the Sierra instead of the DSW40, and took numerous pictures of the operation. We had a great time on the trip."

Logging QRP DX

Steve Yates, AA5TB, writes from Forth Worth, TX, that recently he "worked ZF2SC on Cayman Island on 30 meters.

"No big deal I know and I've worked Cayman Island before, but wait. . .

"I was his first QSO in a pile-up and I was just using my PRC-38S (a.k.a. 38 Special) at 3.5 watts, solar charged battery, and my 3 foot diameter loop up 2 feet off of the ground underneath a bushy pine tree.

"The neat part was after my first call to him I heard many stations calling him on top of me and when the dust settled he came back to me (I did not sign / QRP).

"Then he repeated my rig and antenna information for all the QRO guys waiting in line to hear.

"Just one of the joys of QRP I guess - the ability to get most enjoyment out of every QSO.

"I know, I'm bragging, but that is part of what makes QRP fun.

"I certainly can't brag about a new amp with the new 4CX1600s in it!

"Those of you with antenna restrictions, build a loop and put it 'under the house,' on the balcony, in the attic, or in the bath tub and make some contacts (just kidding about 'under the house.')"

. . . more AT QRP

Ron Polityka, WB3AAL, writes that he headed off for an Appalachian Trail radio adventure recently, arriving at 8 a.m., "and I hiked in about 3/4 of a mile.

"I found a nice big old tree that I shot a line into with my sling shot.

"Tall trees, 40 foot or better, are hard to find on the AT on top of a mountain.

"I learned that fishing line does not travel over wet bark too easily.

"I got my Killer Vertical up and it worked great.

"I called CQ on 40 meters starting at 9:30 a.m. I called for 45 minutes on 7.038 MHz and I had no takers.

"So I went to 30 meters and I had some QSOs with stations on the East Coast. Overall I made 14 contact between 40, 30 and 15 meters.

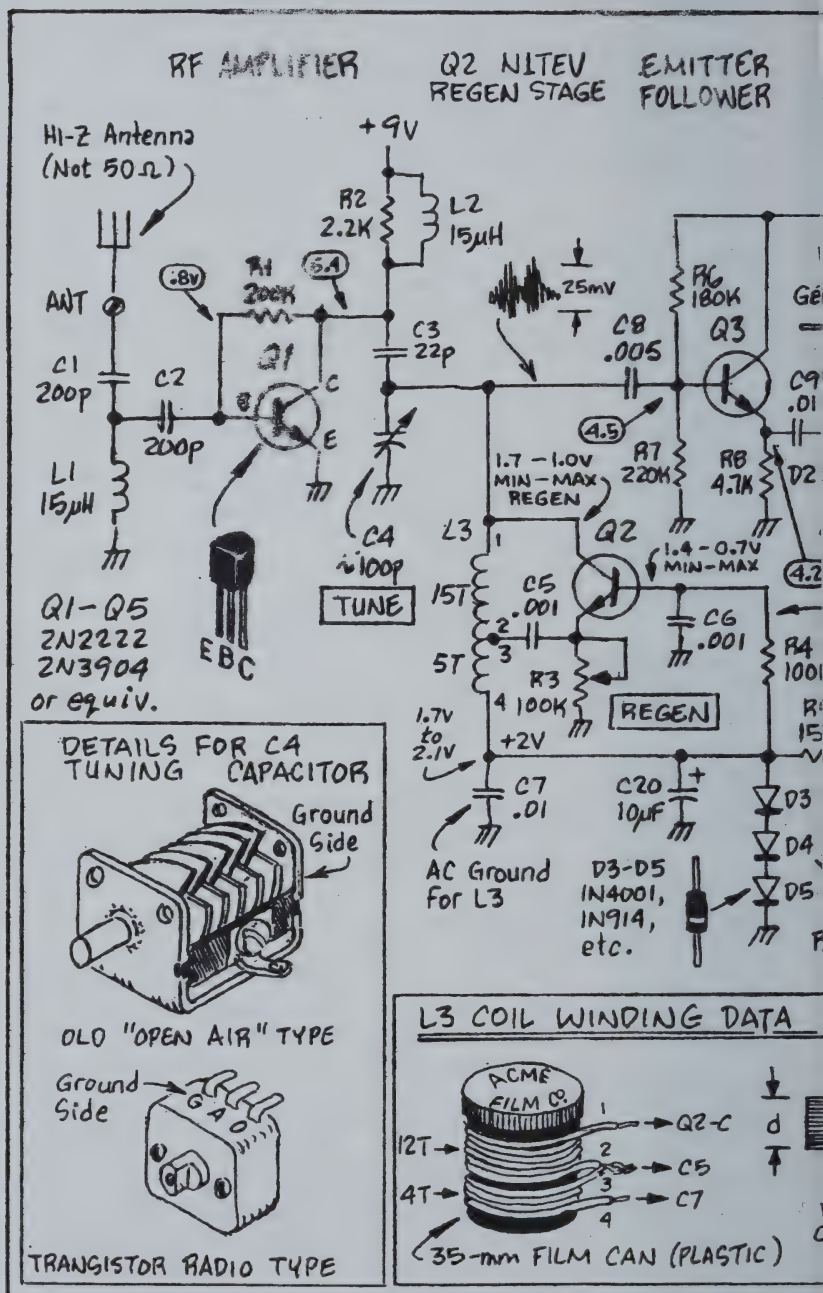
"I also made two SSB contacts with K1QM in Concord, MA and N2SEX the light house in Cap May, NJ.

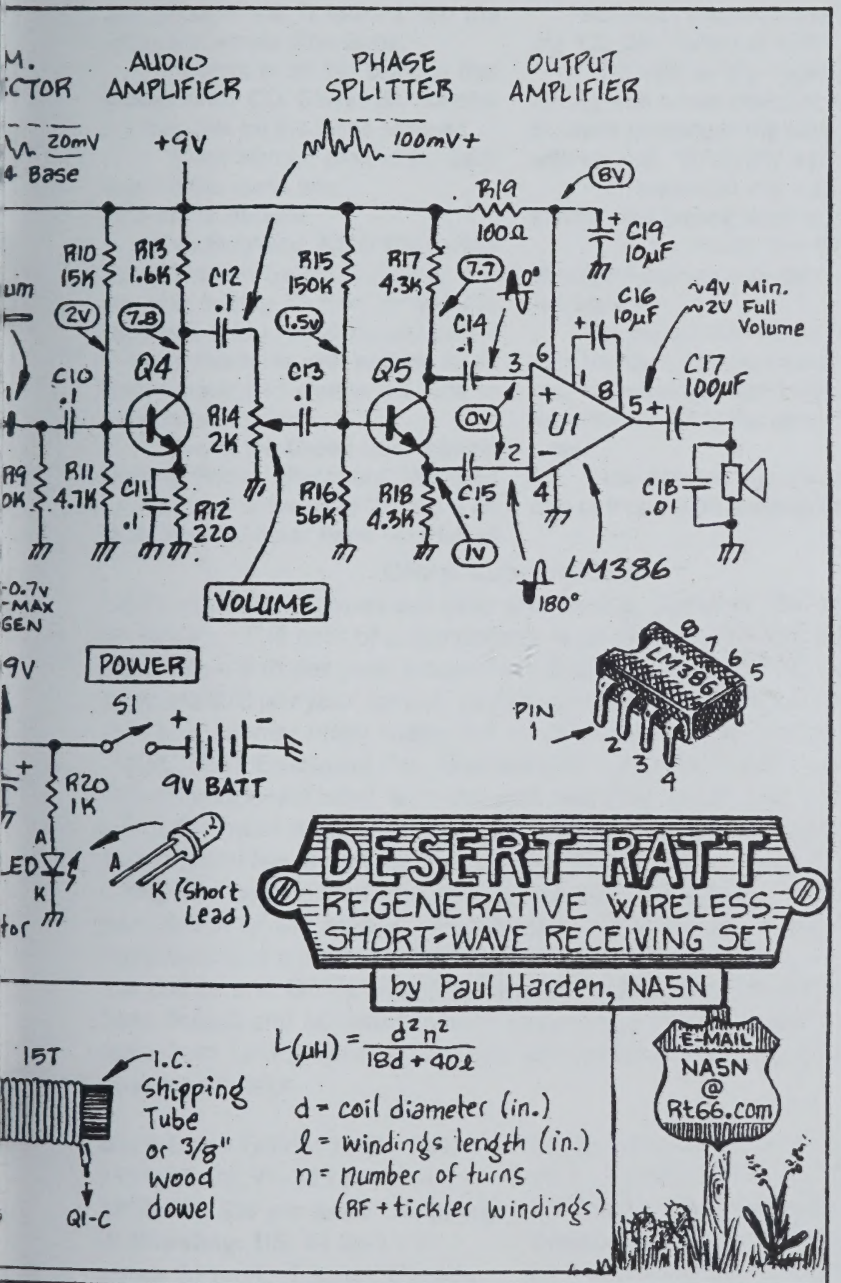
"I had a F6 station call me on 15 meter CW, I went back to him but I had no reply.

"Three deer came up behind me about 300 feet away. I moved and scared them, boy did I jump!

"I saw a flock of starling birds flying through the woods about 2 to 8 feet high off the ground. This flock went on for about 4 minutes.

"About 5 minutes later they cut across the back side and turned toward me. Time for the hat!


RF AMPLIFIER
Q2 NITEV REGEN STAGE
EMITTER FOLLOWER
Hi-Z Antenna (Not 50Ω)
+9V
R2 2.2K
L2 15μH
ANT
.8V
R1 200K
6.4
C1 200p
C2 200p
Q1
L1 15μH
C3 22p
25mV
C8 .005
Q3
R6 180K
C9 .01
4.5
R7 220K
R8 4.7K
D2
1.7 - 1.0V MIN-MAX REGEN
L3
Q2
1.4 - 0.7V MIN-MAX
C4 ~100p
TUNE
15T
C5 .001
C6 .001
5T
R3 100K
REGEN
R4 100
1.7V to 2.1V
+2V
C7 .01
C20 10μF
D3
D4
D5
AC Ground For L3
D3-D5 IN4001, IN914, etc.
Q1-Q5 2N2222 2N3904 or equiv.
E B C
DETAILS FOR C4 TUNING CAPACITOR
Ground Side
OLD "OPEN AIR" TYPE
Ground Side
TRANSISTOR RADIO TYPE
L3 COIL WINDING DATA
ACME FILM Co.
12T
4T
1
2
3
4
Q2-C
C5
C7
d
35-mm FILM CAN (PLASTIC)


M.
CTOR
AUDIO AMPLIFIER
PHASE SPLITTER
OUTPUT AMPLIFIER
20mV
4 Base
+9V
100mV+
8V
R19
100Ω
C19
10µF
R10
15K
R13
1.6K
C12
.1
R15
150K
R17
4.3K
7.7
0°
C16
10µF
~9V Min.
~2V Full
Volume
2V
7.8
1.5V
C14
.1
C17
100µF
C10
.1
Q4
Q5
3
6
1
8
5+
U1
R14
2K
C13
.1
0V
2
R9
0K
R11
4.7K
C11
.1
R12
220
R16
56K
R18
4.3K
C15
.1
4
C18
.01
1V
LM386
180°
-0.7V
-MAX
GEN
VOLUME
9V
POWER
S1
+
-
R20
1K
9V BATT
LED
A
K
A
K (Short Lead)
tor
LM386
8
1
6
5
PIN 1
2
3
4
DESERT RATT
REGENERATIVE WIRELESS SHORT-WAVE RECEIVING SET
by Paul Harden, NA5N
15T
I.C. Shipping Tube or 3/8" wood dowel
Q1-C
$L(\mu H) = \frac{d^2 n^2}{18d + 40\ell}$
d = coil diameter (in.)
ℓ = windings length (in.)
n = number of turns (RF + tickler windings)
E-MAIL
NA5N
@
Rt66.com

"I turned on the speaker and they flew around me. It looked like the Hitchcock movie 'The Birds.'

"Thanks to all the stations that replied to my CQ. Sorry I did not pick out the calls on the weak stations.

"Don't worry, I plan to go back soon to the same site."

PY2 on 10 meters

Ken Hoglund, KG4FGC, writes from Winston-Salem, NC that "the sun was setting, thunder rumbled to the west, and I found myself with a few odd moments with nothing to do before having to shuttle the kids to yet another location.

"Wasn't the Green Bank station starting Friday afternoon? Warmed up the rig and tuned to 28.350 - no luck. The 10-meter band was full of pops, hisses, and rolling signals.

"But wait - sounds like a PY2 calling 'CQ DX.' Why not try?

"So with all the mighty 8 watts the rig was tuned down to, small explosions popping in my ears, I replied with my call. 'QRZed?,' came back.

"I repeated my call, slowly, clearly, and hoping against hope.

"Yup - made the QSO long enough to exchange callsigns and signal reports.

"The moral of the band: Sunspots may be down, flux may be off, a storm may be brewing, there may only be a few minutes left to the band, but QRP rules!

"Now how do I go about getting one of those SSB wallpapers?"

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